

WST2

Washington State Technology Transfer



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**Washington State
Department of Transportation**

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and the Local Technical Assistance Program (LTAP)
Issue 89, Winter 2006

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Cover photo: *Deception Pass Bridge.*

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Perpetual Pavement Concept Renders 20-Year Standard Obsolete

Reprinted from News from the Asphalt Pavement Association of Oregon – Centerline, Volume IX, Issue 2, Summer 2005

“Build your roads like you build your house.” That’s how Jim Huddleston, executive director of the Asphalt Pavement Association of Oregon, sums up his thoughts on the design and construction of roads built for perpetual life. “You don’t build your house with the expectation of having to replace it in 20 years. We shouldn’t build our roads that way either,” he explained.

Huddleston’s argument is that the life expectancy of any road, designed thoughtfully and maintained regularly, could be 50 years or more – not the mere 20 that until recently has been accepted as the standard.

“Perpetual pavement” is a concept that has been developed and marketed primarily for high-volume applications like freeways and interstates. While design and construction specifications are different for low-volume applications, the concept is still applicable, and the results remain the same – a pavement built for long life without requiring major structural rehabilitation or reconstruction, and needing only periodic surface renewal in response to distresses confined to the top of the pavement.



Perpetual pavements are built for long life without requiring major structural rehabilitation or reconstruction.

While up to 70 percent of paved centerline miles in the U.S. could be classified as low-volume roads, no formal standard exists with regard to designing and constructing these roads to meet a perpetual pavement specification. There are two primary reasons why this concept has taken longer to catch on for low-volume applications.

First, “We’ve always done it this way.” Since the interstate program was established, a 20-year life expectancy has been the norm supported by AASHTO guidelines in the U.S., as well as paving standards in other countries. Without the benefit of

knowledge we have today, and with an inability to predict future traffic demands, the Federal Highway Administration historically funded highways that were built to last 20 years, and did not appropriate funds for exploration of designs or concepts with potential for longer life.

Second, there is a misconception of true costs. While highway departments have begun questioning the 20-year approach to road construction in favor of more forward-thinking concepts like perpetual pavement, local agencies often continue to construct 20-year designs on the

premise that they are saving money. It's true that initial construction costs *may* be lower for a 20-year design versus pavement designed for longer life – but that is not always the case, Huddleston explained. And when you consider maintenance and rehabilitation costs over the life of the pavement structures, the savings achieved by perpetual pavement designs can *far exceed* any money saved during initial construction.

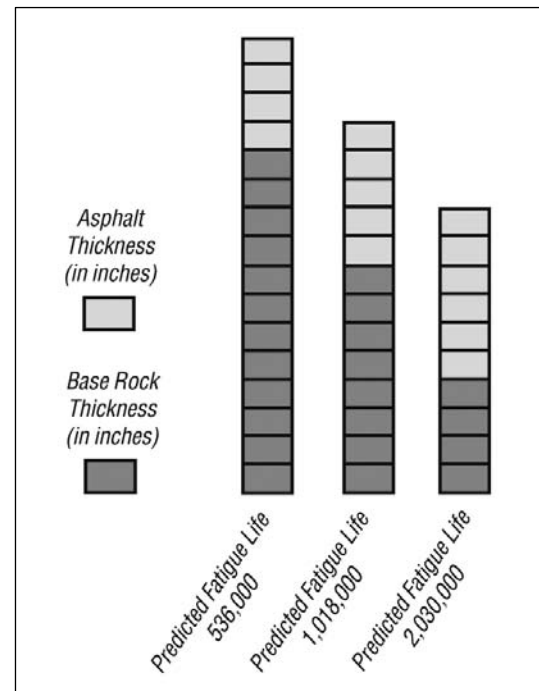
So what is the real difference between a long-life pavement designed for low-volume applications and a more “disposable” option? In the past, common practice was to design the pavement structure utilizing a relatively thick aggregate base and a minimal asphalt surface thickness. These designs were typically adequate to protect the subgrade from deforming, but proved to be inadequate in terms of fatigue resistance in the asphalt layer. In 20 years or less, a road constructed on this premise would have full depth alligator cracking and the all too familiar potholes that come with full depth failures. Corrective options are limited to full depth repairs with thick overlays or total reconstruction – either of which is expensive, time consuming and typically “not in the budget.”

Savings achieved by perpetual pavement designs can far exceed any money saved during initial construction

What we have learned from recent studies and past experience is that the asphalt fatigue life is not highly influenced by the thickness of the aggregate base course. It is, however, very sensitive to the thickness and properties of the asphalt layer. The best approach to optimize the fatigue life, Huddleston explained, is to use only enough aggregate or improved sub-base material to support construction equipment and properly grade the site. “Anything more is a waste of money,” he said.

The remaining structural requirements should be placed in the asphalt layer, a practice which can actually result in savings at the construction stage. Huddleston explained the cost advantages of this approach, stating that approximately 1 inch of additional asphalt can reduce the aggregate base requirement by 4 inches. With 1 inch of asphalt costing roughly the same as 3 inches of aggregate, savings multiply each time the materials are traded. And, thinner aggregate bases require less excavation, resulting in additional savings. Add to that the fact that each additional inch of asphalt effectively *doubles* the fatigue life of the pavement. The following chart illustrates the benefit of an additional inch of asphalt and the potential performance and cost benefits of shifting the primary structural burden from the aggregate layer to the asphalt layer.

Predicted Fatigue Life Increases With Base Rock/Asphalt Tradeoff



“There is a misconception that perpetual pavement designs are much more expensive (than 20-year or disposable pavements),” Huddleston said, “but when you consider the potential to effectively double the structural life on lower volume roads by adding only 1 inch of asphalt thickness, the true cost may not be that much more.” Adding an inch of asphalt to an existing project typically increases the cost only by that of the material delivered to the site. In that case, it is the cheapest inch of asphalt an agency will ever purchase. “When you consider maintenance and rehabilitation costs over the life of the pavement, as well as increased fatigue life, the long-term savings are substantial,” he concluded.



Deception Pass Timber Barrier

Submitted for Presentation at the 84th Annual Meeting of the
Transportation Research Board, Washington, D.C., 2005

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Abstract

Washington State Route 20 in northwest Washington passes through the Deception Pass State Park. The Civilian Conservation Corps (CCC) constructed the portion of SR 20 within the park in the mid 1930s. As part of this work, the CCC constructed a stone masonry bollard and log rail system to delineate the edge of the road and prevent early model vehicles from leaving the roadway (see Figure 1). Due to their age, quality of workmanship, and importance to the surroundings, the bridges and log rails are eligible for the National Register of Historic Places.

Previous attempts to replace this rail with a crashworthy system were unsuccessful due to concerns for preserving the aesthetic and historic integrity of the park. A new approach was adopted that began with understanding the context of the highway and the concerns of the other stakeholders. In addition, the stakeholders were educated on the safety issues. As a result, a solution was developed that was acceptable to all of the stakeholders. The primary solution involved the development of a new barrier that replicated the appearance of the original log rail. This barrier was crash tested in accordance with the NCHRP Report 350 TL-2 criteria and is available for use in other locations where an aesthetic barrier is desired.

Historical Background and Setting

Washington State Route 20 is a National Highway System (NHS) highway providing the most northerly east-west route in Washington State. In Northwest Washington, SR 20 passes through Deception Pass State Park and provides the only highway connection between Whidbey Island and the mainland.

Deception Pass State Park is a 4,134-acre marine and camping park with 77,000 feet of saltwater shoreline, and 33,900 feet of freshwater shoreline on four lakes. Two bridges carry SR 20 over Deception and Canoe passes (see Figure 2). The park includes sheer cliffs, water views, old-growth forests, and abundant wildlife. It is the most popular state park in Washington.

Traffic and Accident History

The highway usage has changed significantly since the CCC built the road in the mid 1930s. Currently, the ADT is 15,000 and the 85 percentile speeds vary between 36 and 45 mph. Within the 2-mile segment of SR 20 inside Deception Pass State Park, there were 10 accidents in 1980 and 22 accidents in 2000. Fifty percent (or approximately 11) of the accidents involved vehicles hitting fixed objects on the roadside. Forty five percent of these "hit fixed object" accidents involved the log rail system (approximately five per year). Sixty percent of the accidents involving the rail result in an injury. Most accidents occur during the summer months during peak tourist season. As a result of this history, this section of roadway is considered a High Accident Corridor (HAC).



Figure 1. CCC bollard and log rail system.



Figure 2. Deception Pass Bridge.

Design Process

In the early 1990s, a project was initiated to replace the log rail with a crashworthy barrier system. At that time, it was proposed to install a W-Beam guardrail. However, significant concerns were raised by the Washington State Parks and Recreation Commission (WSPRC), which stated, "State Parks does not approve of the proposal to remove these guardrails or of plans that would destroy the historic integrity of this site." Due to the resistance from the WSPRC, the project was cancelled.

In 2000, a new project was initiated to address the safety concerns discussed previously. This time, an aesthetic steel backed timber guardrail was proposed. However, the WSPRC again felt that removing the historic log rail system and replacing it with steel-backed timber guardrail would compromise the integrity of the park and they did not give the proposal a warm reception.

It was at this point that WSDOT started to approach this project differently. The WSDOT design team realized that because of the previous attempts to remove the historic log rail, the WSPRC did not feel that there was an understanding of the concerns. Conversely, WSDOT did not feel that there was an understanding of the safety concerns.

To reach a solution that would be acceptable, WSDOT assured the stakeholders that new alternatives would be considered and evaluated before choosing a preferred solution.

WSDOT brought stakeholders together for a series of meetings with representatives from Island County Public Works, South Whidbey Historical Society, WSPRC, State Office of Archaeology and Historic Preservation (OAHP), WSDOT, FHWA, and Washington State Patrol. At the initial meeting, the following process was agreed upon:

- Develop mission statement.
- Brainstorm solutions.
- Investigate feasibility of solutions.
- Educate stakeholders on roadside safety.
- Define character defining features.
- Develop decision matrix.
- Complete decision matrix with facilitator.
- Complete additional investigation.
- Select preferred solution.

The group adopted the following mission statement for this project:

Reduce the number and severity of injury accidents, while maintaining the integrity of the park.

The adoption of a mission statement was very important to this process as it helped keep the team focused. The team brainstormed 27 different alternatives to meet the mission. The team then constructed a decision matrix to step through the assessment of each brainstormed alternative, agree on a quantitative score, and reach and agree on the optimal decision. Criteria used for selecting preferred alternative were: Retention of Character Defining Features, Ease of Maintenance, Reduction in Severity of Accidents, Reduction in Number of Accidents, and Aesthetics. A facilitator assisted the group in separating solutions into guardrail and non-guardrail solutions to "further investigate," and alternatives that deserved no further investigation. At this point, based on input from barrier design experts, it was determined that it was not feasible to retrofit the existing rail to make it crashworthy. The products of the decision matrix were nine non-barrier related solutions to further investigate, three barrier related solutions to further investigate, and 15 solutions that warranted no further investigation.

There was a considerable effort to increase the understanding of team members on roadside safety concerns as well as aesthetic and historical concerns for this location. After reviewing the accident history and the background on roadside safety tools such as crash testing, the team agreed that some type of improvement to the rail was appropriate. It was also agreed that this improvement needed to be sensitive to the park context.

As WSDOT incorporated WSPRC and OAHP's ideas and listened to their concerns, the initial adversarial relationship disappeared. Three solutions rose to the top for further analysis and consideration. The development of a new barrier system that replicated the original log rail system was the preferred solution. In addition,

WSDOT will work with WSPRC to improving signing in the park and a highway advisory radio system has been constructed to the north of the project site.

It was also agreed that a 250-foot section of original rail will be left in place to allow visitors to view the original system, and rocks from some of the original bollards will be used in the construction of the new system. The original CCC guardrail system will be documented and archived according to Historic American Engineering Record (HAER) Level 2 documentation, and interpretive signs will be constructed near the preserved section of rail.

Barrier Design

The integrity of the park is linked to maintaining character-defining features of the original CCC rail. WSPRC said that, "Deception Pass State Park is the State's finest example of CCC park construction. For those visitors passing through on Highway 20, the guardrails may be the only evidence of CCC work they will see." To provide direction for the development of a replacement railing, the team identified 10 character-defining features of the original CCC rail. The character defining features were as follows:

1. The bollards (supports) are constructed of rock and mortar.
2. The bollards have a distinctive shape (batter, shoulders, approximate dimensions).
3. Roadway users have the ability to see over and under the rail.
4. The log rails are wood.
5. The bollard spacing is about 18 feet.
6. Because they are hand crafted, the bollards are non-uniform.

7. The log is discontinuous and aligned at the center of the bollards.

8. The log rail sits on the bollard's shoulders.

9. The logs have taper.

10. The spacing of the bollards is non-uniform.

WSDOT contracted with the Texas Transportation Institute (TTI) to develop a crashworthy barrier that incorporated as many of these character-defining features as possible. It was assumed that since a rock support was desired, the barrier would have to be a rigid system with little or no deflection. The barrier design would be tested in accordance with the National Cooperative Highway Research Program (NCHRP) Report 350 (1) criteria for Test Level 2 conditions. For Test Level 2 conditions, a design force of 27 kips distributed over a distance of four feet was used to design the log rail and supports, in accordance with the AASHTO LRFD Bridge Design Specifications (2). In addition to a conventional ultimate strength analysis of the log rail, structural computer modeling of the log rail design was performed using the structural engineering program RISA-3D.

The barrier that was developed consisted of a steel backed log that is supported by stone fascia bollards (see Figure 3). The steel backed timber log rail consisted of 12-inch diameter "turned" Douglas Fir logs. The logs were sawn with a 6-inch flat back to accommodate a 6-inch wide by $\frac{3}{8}$ inch thick steel plate. The plates were attached to the back of the log using wood lag screws. The height to the top of the log is 27 inches from the ground.

The bollards were designed with a natural stone facade over a reinforced concrete core, footing, and an 18-inch diameter reinforced concrete shaft. It is expected that this foundation may be modified depending on site conditions (depth of rock, etc.). The stone supports were designed for an 18-foot maximum spacing and may be installed at lesser spacing to give the barrier a non-uniform appearance. To achieve the 18-foot spacing, it was determined, based on the analyses and computer modeling, that an intermediate support was necessary. The intermediate support consists of a steel pipe support with a reinforced concrete shaft foundation. The initial design used an 8-inch diameter pipe. However, in the final design, this was changed to a 6-inch pipe to make it less noticeable.

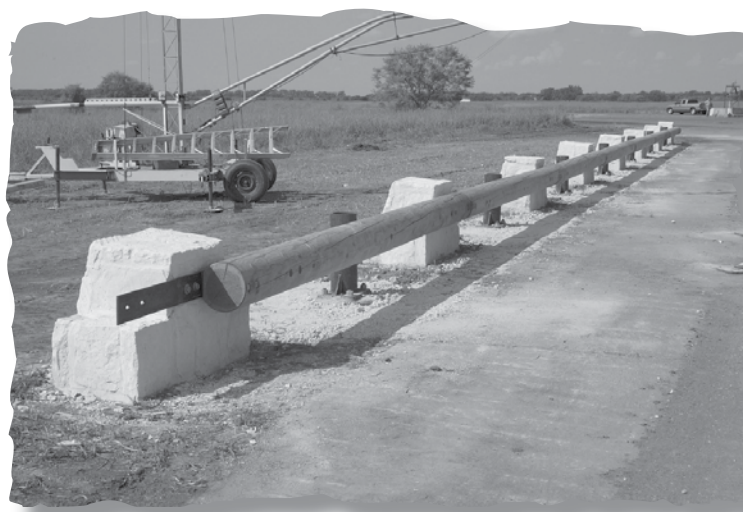


Figure 3. Prototype Barrier.

In the initial design, each end of the logs was attached to the bollards with two $\frac{7}{8}$ inch diameter bolts (4 bolts on each bollard) that bolted through the logs and steel plates and connected to anchors which were embedded into the concrete core walls within the stone-faced bollards. However, during construction of the test installation, this design proved to be very difficult to construct. As a result, the connection was modified to include two shorter ($2\frac{1}{2}$ inches long) $\frac{7}{8}$ -inch diameter bolts, which were used to secure the $\frac{3}{8}$ -inch thick steel splice plate to the bollards. The logs were “notched” four inches on each end and the adjoining steel backed plates were shortened by the same amount to accommodate the connection of the steel splice plates to the bollards. The steel backed logs were then secured to the steel splice plates using three $\frac{3}{4}$ -inch diameter bolts that bolted through the logs with steel-backed plates and through the steel splice plates. A third bolt was added on each ends of each log to increase the capacity of the connection between the steel-backed logs and steel splice plates.

This design incorporated 6 of the 10 character defining features that were previously identified. Details of the final design are shown on Figure 8.

NCHRP 350 Compliance Testing

NCHRP Report 350 provides guidance for conducting crash tests to evaluate highway safety features. NCHRP Report 350 has three test levels that are based on the speed of the impacting vehicle. Test Level 2 (TL-2) uses a speed of 70 km/h (43 mph) and this is appropriate for this section of highway. According to NCHRP Report 350, two crash tests are typically performed to evaluate longitudinal barriers to TL-2, one with an 820 kg (1800 pound) small car (Test 2-10) and the other with a 2000 kg (4400 pound) pickup truck (Test 2-11).

The small car test is primarily to assess occupant risk and with a rail system, a primary concern is for snagging on the supports. Based on a review of other steel backed timber rails that have already been approved by FHWA (4), it was determined that this test was not necessary. The barrier will have approximately 12 inches of separation from the front edge of the log to the support, which is more than other timber rails, and with a TL-2 speed of 70 km/h (43 mph), it was decided that this barrier would perform at least as well as the other approved barriers with this vehicle.

The pickup truck test is intended to evaluate the strength of the section for containing and redirecting the pickup truck.

A 126-foot long test installation was constructed to evaluate the performance of this barrier. Two tests were performed and are summarized as follows.

Test 400561-1 (5)

Test Description

The initial design described previously was tested with a 4514 lb (2050 kg) pickup truck, traveling at a speed of 44.5 mi/h (71.6 km/h). The vehicle impacted the Deception Pass Log Rail 3.3 feet upstream of

the leading edge of bollard 5, at an impact angle of 25.1 degrees. This impact location was determined to be the critical impact point to evaluate the potential for snagging of the tire on the rigid bollards. At 0.040 s after impact, the left front tire began to travel under the log rail element, and at 0.050 s, the vehicle began to redirect. The left front tire contacted and snagged on the leading edge of bollard 5 at 0.055 s, and the right front tire and wheel turned in toward the rail. At 0.271 s, the front of the vehicle lost contact with the log rail element, and at 0.337 s, the vehicle was traveling parallel with the rail at a speed of 29.7 mi/h. The rear of the vehicle contacted the rail element at 0.368 s. At 0.670 s, the vehicle lost contact with the log rail element and was traveling at an exit speed of 26.8 mi/h and an exit angle of 11.6 degrees. As the vehicle continued forward, it yawed counterclockwise and contacted the log rail again at 2.139 s. The vehicle subsequently came to rest adjacent to the end of the installation.

Damage to Test Installation

Damage to the log rail was primarily to the timber log element, as shown in Figure 4. The log element was gouged to a maximum depth of 0.8 inches near bollard 5. Tire marks extended 3.5 inches under the log element just downstream



Figure 4. Barrier damage from Test 400561-1.



Figure 5. Vehicle damage from Test 400561-1.

of the splice at bollard 5. Bollard 5 was pushed toward the field side 0.4 inches. The vehicle was in contact with the log element for 11.5 feet. Maximum dynamic deflection was not measurable.

Vehicle Damage

The left front quarter of the pickup truck sustained most of the damage, as shown in Figure 5. Structural damage was imparted to the left upper and lower A-arm, left outer tie rod, and left frame rail. Also damaged were the front bumper, grill, left front quarter panel, left front tire and wheel rim, left door, and left rear wheel rim. Maximum exterior crush to the vehicle was 25.0 inches in the frontal plane at the left front corner near bumper height.

Maximum occupant compartment deformation was 2.3 inches in the center front floorpan over the transmission tunnel.

Occupant Risk Values

In the longitudinal direction, the occupant impact velocity was 21.0 feet/s at 0.131 s, the maximum 0.010 s ridedown acceleration was -4.0 g's from 0.140 to 0.150 s, and the maximum 0.050-s average was -8.7 g's between 0.064 and 0.114 s. In the lateral direction, the occupant impact velocity was 17.1 feet/s at 0.131 s, the highest 0.010-s occupant ridedown acceleration was 4.0 g's from 0.464 to 0.474 s, and the maximum 0.050 s average was 7.8 g's between 0.063 and 0.113 s.



Figure 6. Barrier damage from Test 400561-2.

This test met all of the evaluation criteria in NCHRP Report 350. A summary of the test information is shown on Figure 9.

Test 400561-2 (6)

While the crash performance of this design was acceptable, there were some concerns about the constructability of this system and a few modifications were made to the steel backed log rail design as was discussed previously. As a result of these modifications, an additional test was performed to ensure the changes did not affect the performance of the system.

Test Description

The final design was tested with a 4529 lb (2056 kg) pickup truck, traveling at a speed of 44.7 mi/h (71.9 km/h). The vehicle impacted the Deception Pass Log Rail with the right front corner of the front bumper at the location of the center-line of post 6 and at an impact angle of 24.4 degrees. This impact location was determined to be the critical impact point to evaluate the strength of the intermediate support since the first test established that snagging on the bollards was not critical. At approximately 0.045 s after impact, the right front tire and wheel rim gouged into the timber rail, snagging slightly, and by 0.056 s after impact, the pickup truck began to redirect. The front of the vehicle lost contact with the timber rail at 0.291 s, and at 0.392 s, the vehicle was traveling parallel with the installation and traveling at a speed of 26.0 mi/h. The rear of the vehicle contacted the timber rail at 0.467 s. At 0.708 s, the vehicle lost contact with the timber rail, and was traveling at an exit speed of 22.0 mi/h and an exit angle of 6.5 degrees. The vehicle subsequently yawed towards the installation and contacted the timber rail a second time at 1.376 s. The vehicle came to rest adjacent to the timber rail at post 13, approximately 60 feet downstream of impact.

Damage to Test Installation

Damage to the log rail was primarily to the timber log element, as shown in Figure 6. The log element was gouged and tire marks extended along the face of the log. Only Bollard 6 was disturbed. The vehicle was in contact with the log element 12.5 feet. Maximum dynamic deflection was not measurable.

Vehicle Damage

The right front quarter of the pickup truck sustained most of the damage, as shown in Figure 7. Structural damage was imparted to the right upper A-arm, right side floor pan, and right frame rail. Also damaged were the front bumper, grill, right front quarter panel, right front tire and wheel rim, and right door. Maximum exterior crush to the vehicle was 23.6 inches in the frontal plane at the left front corner near bumper height. Maximum occupant compartment deformation was 2.5 inches in the center front floor pan over the transmission tunnel.

Occupant Risk Values

In the longitudinal direction, the occupant impact velocity was 23.0 feet/s at 0.135 s, the maximum 0.010 s ridedown acceleration was 4.2 g's from 0.135 to 0.145 s, and the maximum 0.050 s average was -8.9 g's between 0.063 and 0.113 s. In the

lateral direction, the occupant impact velocity was 16.7 feet/s at 0.135 s, the highest 0.010 s occupant ridedown acceleration was -3.9 g's from 0.135 to 0.145 s, and the maximum 0.050 s average was -6.8 g's between 0.061 and 0.111 s.

This test met all of the evaluation criteria in NCHRP Report 350. A summary of the test information is shown on Figure 10.

Conclusions

After several failed attempts to replace an old non-crashworthy railing in the Deception Pass State Park, the WSDOT took a different approach that engaged the stakeholders and jointly developed a solution. A very deliberate process was followed that helped ensure that all of the stakeholders understood the other stakeholders concerns. With an understanding of the safety issues related to the state highway and the scenic and historic issues that are a major concern in the park, an acceptable solution was developed that included the development of a new barrier that replicated, to the extent possible, the appearance of the original barrier. This barrier was crash tested in accordance with the NCHRP Report 350 TL-2 criteria and is available for use in other locations where an aesthetic barrier is desired.

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Figure 7. Vehicle damage from Test 400561-2.

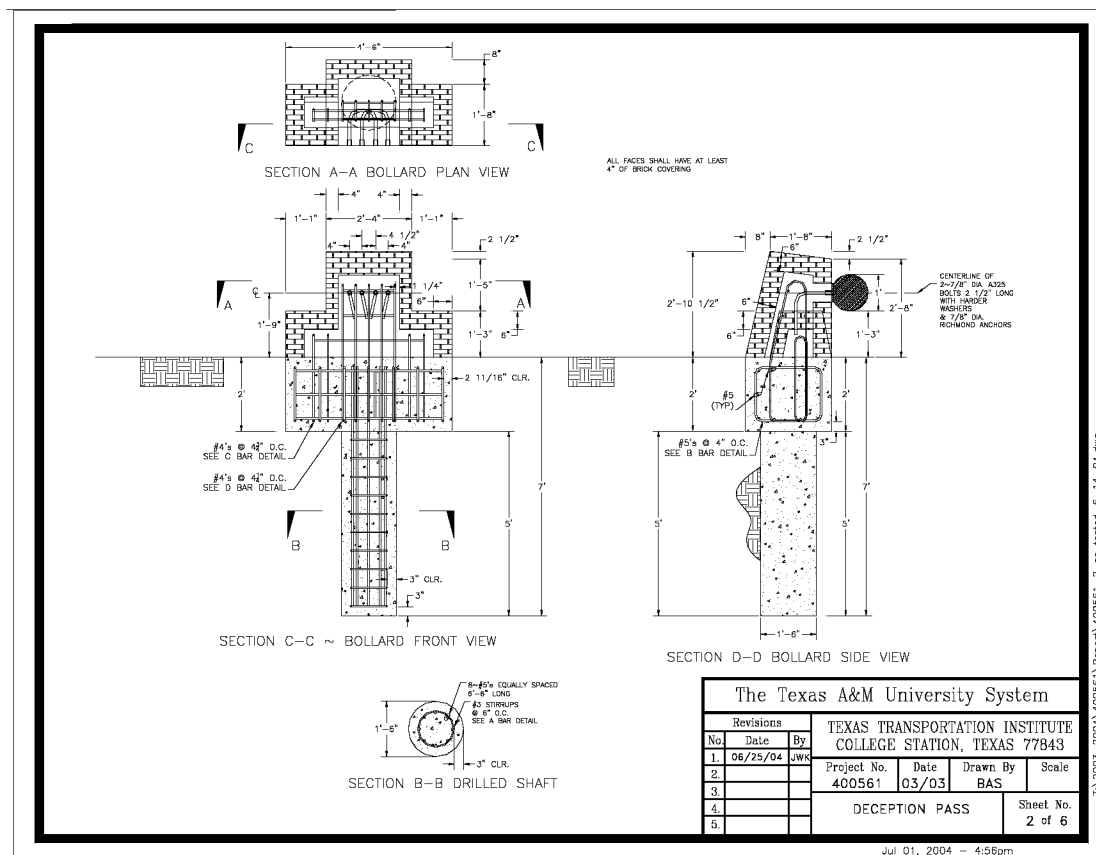
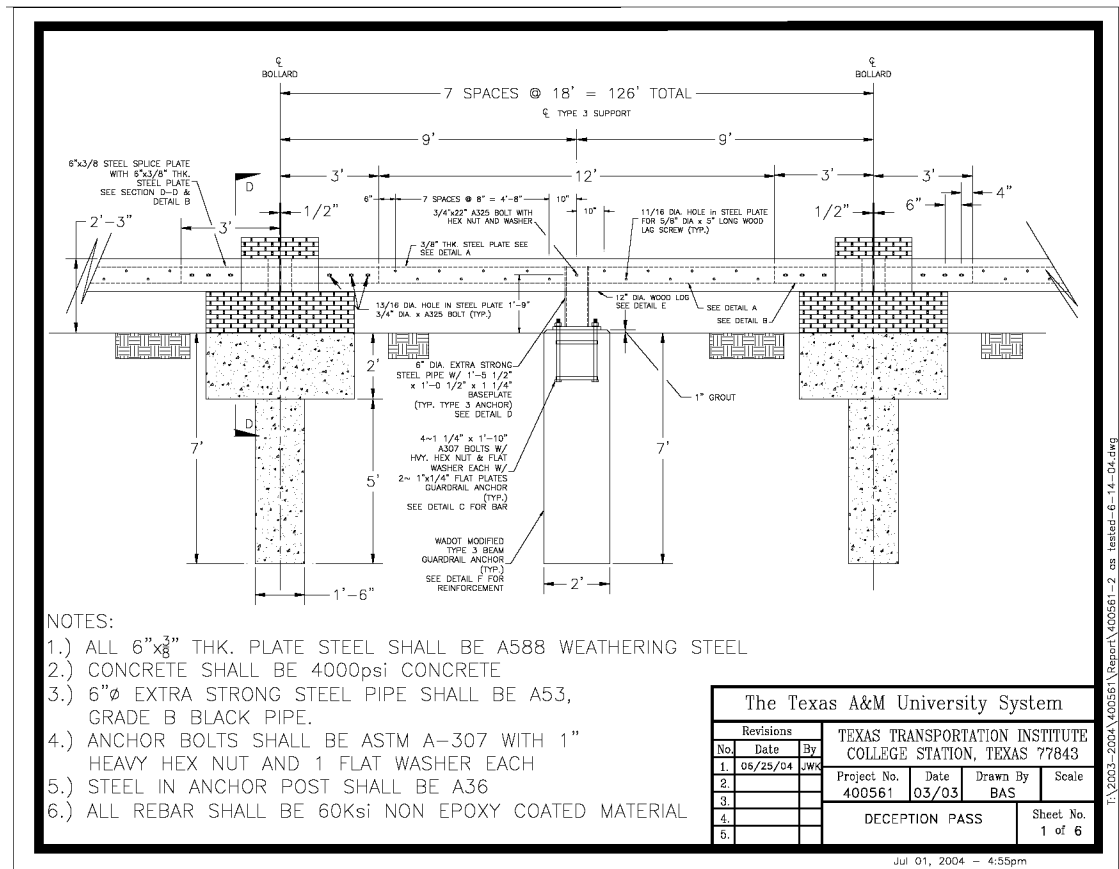


Figure 8. Deception Pass Log Rail details.

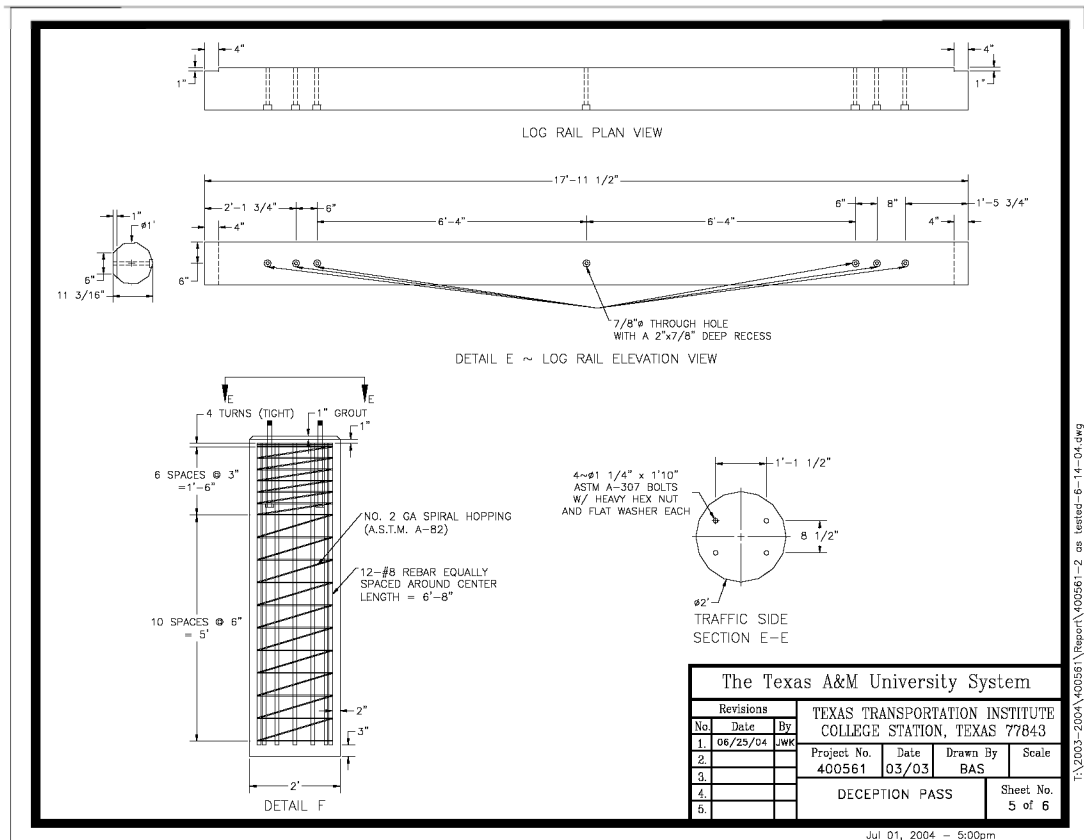
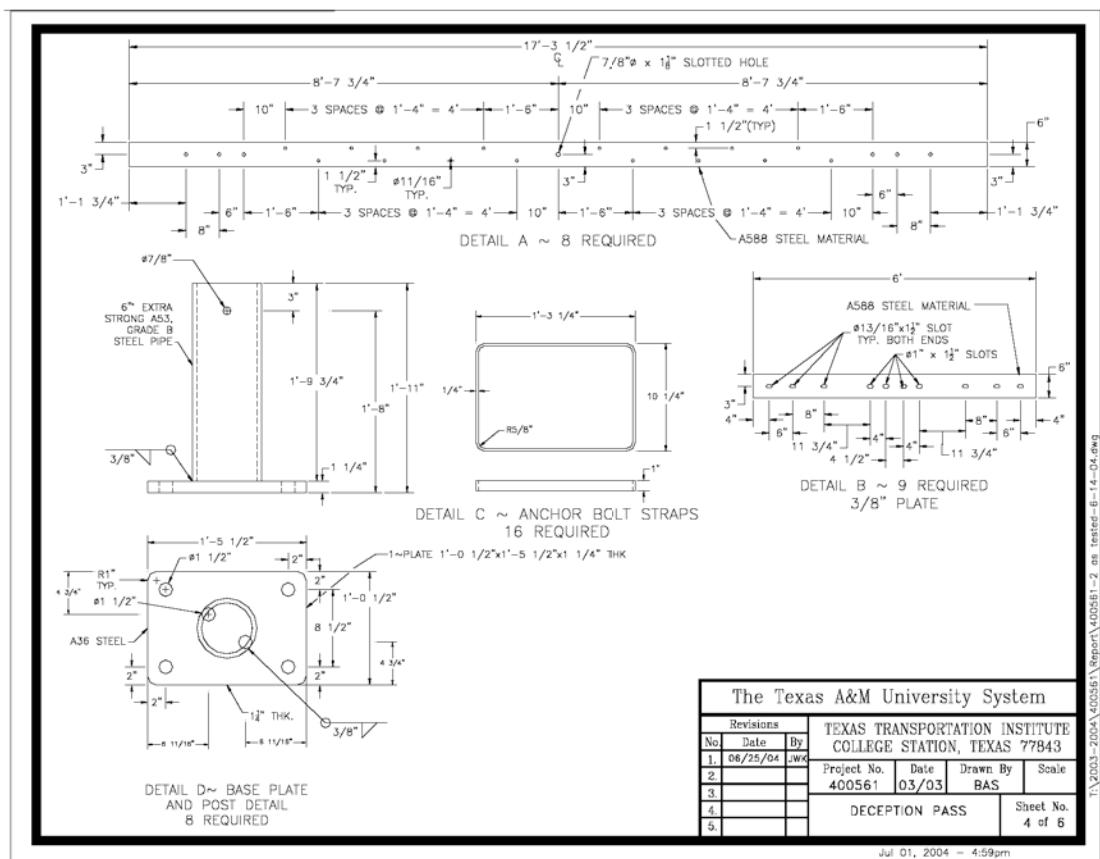


Figure 8. Deception Pass Log Rail details (continued).

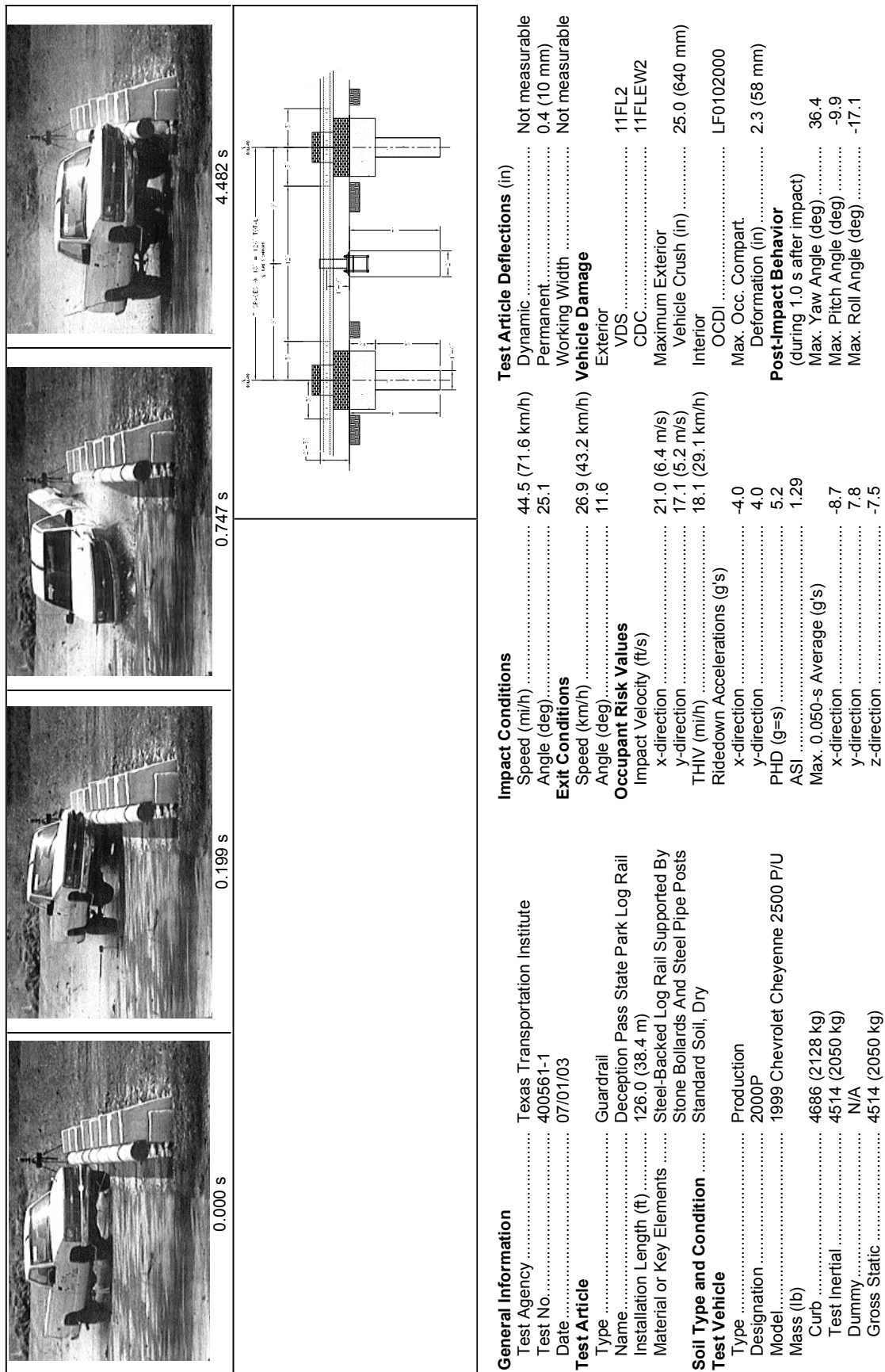


Figure 9. Summary of test results – Test 400561-1.

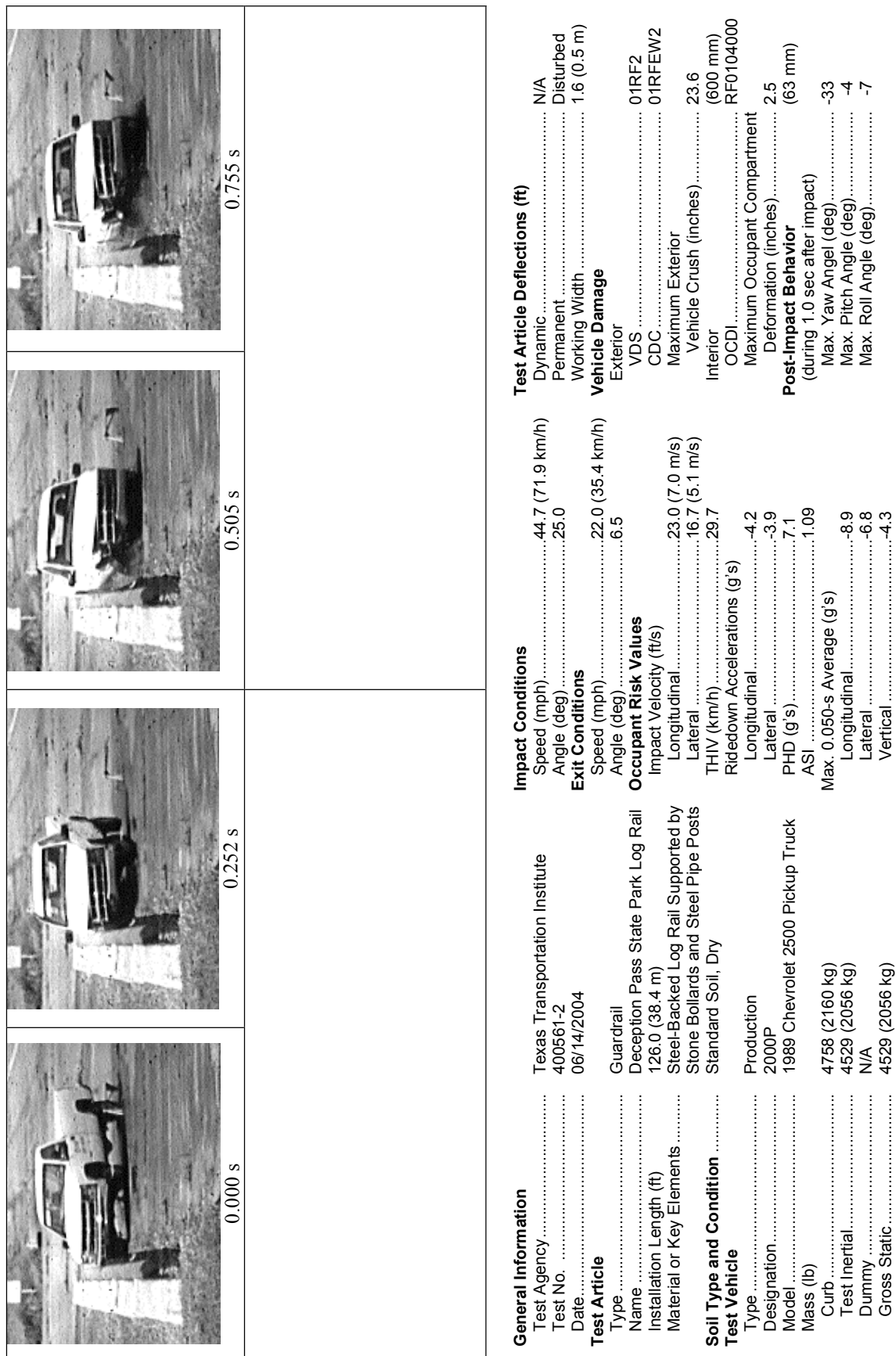


FIGURE 10 Summary of test results – Test 400561-2.

Development of a Tack Coat Protocol

Background

The Washington State Department of Transportation (WSDOT), along with the State Pavement Technology Consortium (SPTC) states of California, Minnesota, and Texas, initiated a research study for evaluating tack coat. Tack coat is typically an emulsified asphalt that is placed between lifts of hot-mix asphalt (HMA) to bond the layers together. The assumption is if the bond between the layers is insufficient, the pavement layers may act independently of each other and the newly placed overlay will fail prematurely due to its inability to sustain heavy wheel loads.

Participants

As stated, WSDOT and the other three state DOT's of California, Minnesota, and Texas were participants in designing and funding this study. Florida DOT, an ex-officio member of the SPTC is also contributing to the effort by performing shear testing of cores at no cost. Other participants included Woodworth and Company (Tacoma, Washington) and Lakeside Industries (Olympia, Washington). Woodworth graciously contributed to the building of the test sections by grinding the existing pavement and placing and compacting the HMA for just the cost of the materials, while Lakeside graciously provided and placed the tack coat. Figure 1 illustrates the collaborative effort of the Contractor's in making this study happen. Special thanks go to John Grisham of Woodworth and Dave Bell of Lakeside.



Figure 1. Lakeside Industries tack truck placing tack in front of Woodworth and Company paver.

Special thanks also go to WSDOT's Olympic Region (Mel Hitzke, Terry MacAuley, Dave Mayoh, Mark Willoughby), Northwest Region (Mark Rickert), and Headquarters Materials Laboratories (Jeff Uhlmeyer, Jim Weston), Olympic Region Maintenance (John Brooks), WSU (Laith Tashman), FHWA (Cathy Nicholas), and University of Texas at El Paso (Vivek Tandon) staff for their assistance during construction and testing.

Test Sections

The goal of this research was to investigate different application rates (including no tack coat), condition of the tack coat (broken and unbroken), and surface textures (milled versus overlay). The HMA placed was a Superpave ½ inch and the existing pavement was a ½ inch NMAS dense-graded HMA. The lift thickness was approximately 2 inches. Prior to placing the tack coat, the surface was cleaned via a broom. The tack coat was an undiluted CSS-1. In all, 14 test sections were placed (Figure 2), with each section being approximately 50 feet long and 14 feet wide (except test sections 7 and 8 – both were full-width (28 feet)).

Overlay	13	0.07 gal/sy	14	0.07 gal/sy
	11	0.05 gal/sy	12	0.05 gal/sy
	9	0.02 gal/sy	10	0.02 gal/sy
	8	No tack coat		
	7	No tack coat		
Milled	5	0.07 gal/sy	6	0.07 gal/sy
	3	0.05 gal/sy	4	0.05 gal/sy
	1	0.02 gal/sy	2	0.02 gal/sy
	Broken		Unbroken	

Figure 2. Test sections with tack coat target residual application rates listed.

The test sections were placed in Olympia, Washington, on September 13, 2005. The air temperature and wind speed were approximately 73°F and 3 mph, respectively. The application rate was determined for each of the test sections. Each of the 6 test sections for the broken tack coat were placed first and then tested with the UTEP Pull-Off Device once the tack had broken. The HMA was placed after testing, followed by the unbroken tack coat sections. The tack coat was placed directly in front of the paver for the unbroken sections (there was approximately 2 minutes between the placement of the tack coat and the HMA for each section). Figure 3 shows the unbroken tack coat (rate of 0.02 gal/sy) on a milled portion as the HMA is delivered to the paver. Figures 4 and 5 illustrate the different tack coat rates on the milled and overlay surfaces, respectively.

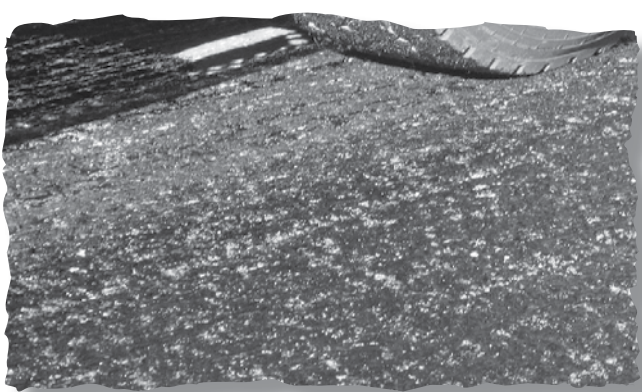


Figure 3. Paving over unbroken tack coat.

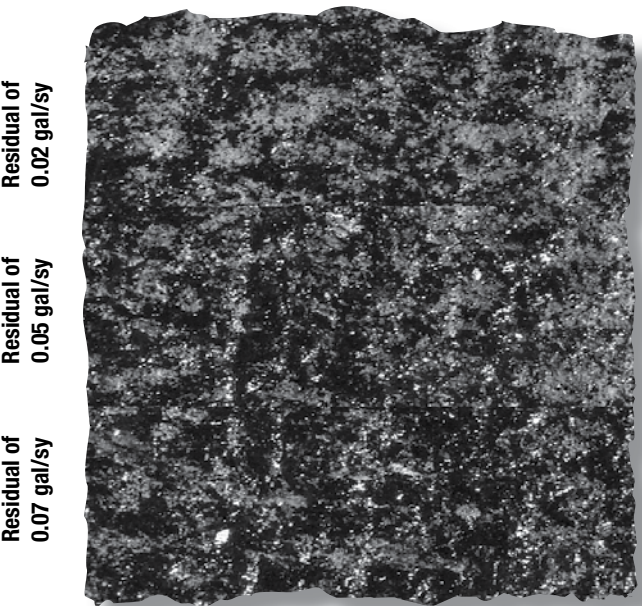


Figure 4. Varying residual tack coat rates (approximate) on the milled surface.

Once the paving and compaction efforts were completed, in-place density was determined and coring commenced. Five nuclear density tests were taken in each test section and ranged from a low of 86.6 to a high of 96.6 percent with an overall average of 92.9 percent (standard deviation of 1.95). The individual test section averages ranged from 91.3 to 94.5 percent.

There were 161 6-inch cores taken from the test sections. The plan was to take 12 cores from each test section – 6 in the wheelpath and 6 in the middle of the lane. In test section number 8 – the no tack overlay section – only 5 cores were taken due to lack of bond between the new overlay and existing pavement. Three cores from each location (wheelpath and middle of lane) will be tested via the UK Torque Bond Test and Florida DOT Shear Test (Figure 6).

Florida DOT received 77 cores that will be tested for shear (1 core broke at the paving interface while removing) and 78 cores will be tested using the torque test at the Materials Lab in Tumwater.

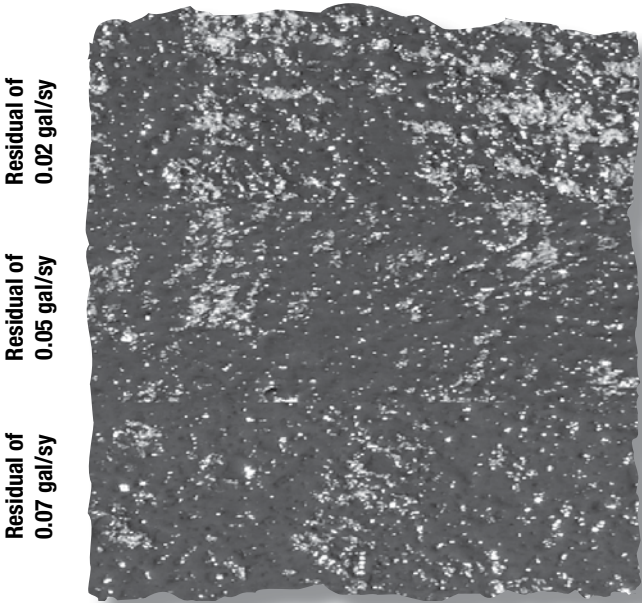


Figure 5. Varying residual tack coat rates (approximate) on the existing surface (overlay).

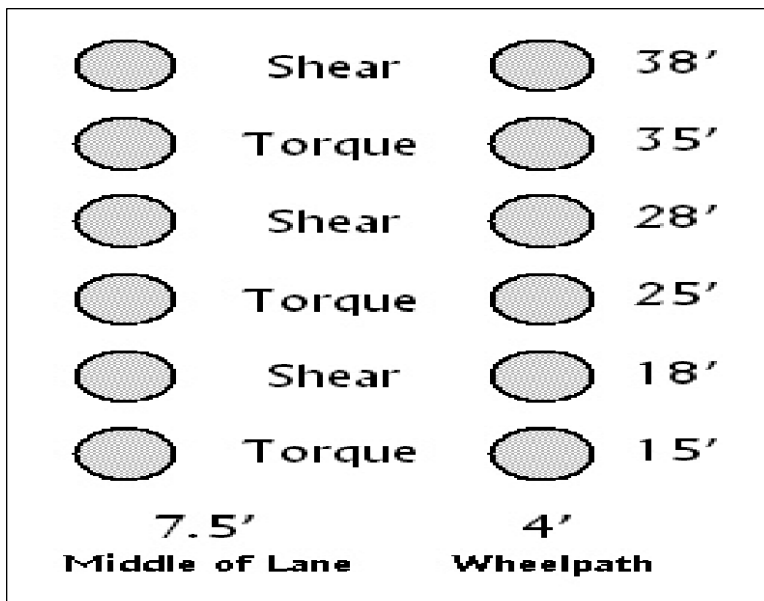


Figure 6. Core location for each test section (minor changes were made to actual locations in two sections so that representative samples could be taken).

Next Steps

Once all the testing is complete, Washington State University (WSU) will analyze the data. A final report will be produced, which will include guidelines for the use of tack coat.

A recommendation for Quality Control/Quality Assurance (QC/QA) testing may be provided depending on the results of the QC test (Pull-Off) and the QA tests (Torque and Shear). The final report will be available in March of 2006.

How Agencies Can Use This Information

Agency project designers and construction engineers can use this preliminary information to demonstrate the need for the use of tack coat and will have access to the guidelines and recommendations in March 2006.



For more information, contact Kim Willoughby in the WSDOT Research Office at (360) 705-7978.

The *Gray Notebook* is a quarterly publication published by the Washington State Department of Transportation to track a variety of performance and accountability measures for review by the Transportation Commission and others.

The following is a sampling from this document. For an on-line version of this or previous editions of the *Gray Notebook*, visit <http://www.wsdot.wa.gov/accountability/>



**Washington State
Department of Transportation**

Measures, Markers and Mileposts

The Gray Notebook for the quarter ending
September 30, 2005

WSDOT's quarterly report to the Governor and the
Washington State Transportation Commission
on transportation programs and department management

Douglas B. MacDonald
Secretary of Transportation



Highway Construction: Quarterly Update

Construction Industry Costs Advertisement Prices

The construction industry across the country is buzzing with discussion of price run-ups for construction inputs including materials, fuel, equipment, and labor. Adverse trends had been apparent throughout the last year, especially for steel (heavy overseas demand, although a price surge seemed to begin to level off somewhat during mid-2005), cement (supply shortages) and energy (upward trends for fuel for construction equipment and energy inputs into materials).

In the aftermath of Hurricane Katrina (and then, to a lesser extent, Wilma), concerns heightened especially at the prospects of still higher energy prices as well as new demand-side pressure on industry resources from Gulf area re-building. The Gulf States situation also raises concerns for shortages of skilled labor and experienced construction engineers and project managers, as well as overall construction industry capacity. Conversations with construction industry experts also touch on potential difficulties for contractors' access to surety bonding. Discussions also address the adverse implications for the true competitiveness of pricing in the industry from the on-going trends toward industry concentration, i.e., fewer and fewer big contractors taking more and more of the overall industry pie.

In recent weeks, news has been spreading among state and local transportation departments of "sticker shock" as bid openings have shown contractors' pricings appreciably above project estimates.

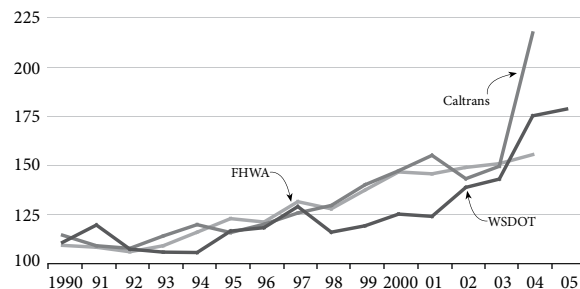
Some of WSDOT's recent bid openings have not been reassuring. For example, WSDOT recently opened bids on SR 3 – SR 303 Interchange, and despite the agency's efforts to incorporate the impact of cost escalation into the estimate, WSDOT still missed the low bid by almost 17%. The second and third low bids were in the same general range. WSDOT's estimate was \$14.33 million, while the low bid was \$16.74 million. WSDOT is currently analyzing the bid tabs to understand the differences, but the initial impression is that the cost of fuel in equipment and trucking, as well as the steel cost in the bridge superstructure and sign structures, are the major areas contributing to this difference.

On a positive note, WSDOT opened bids on I-5 48th to Pacific in late June and was pleased to find the low bid to be under the engineer's estimate by 4.7%. This project was awarded to

Annual Construction Cost Index

WSDOT Base 1990 = 110

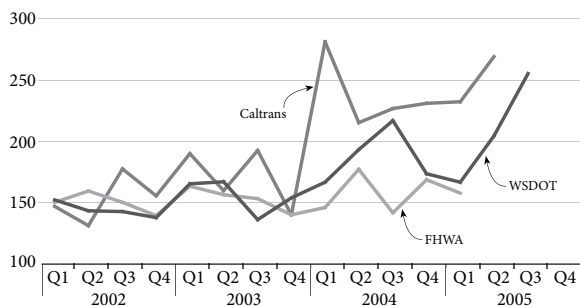
FHWA and Caltrans Base 1987 = 100



Quarterly Construction Cost Index

WSDOT Base 1990 = 110

FHWA and Caltrans Base 1987 = 100



"Sticker shock" is exactly what the Arizona DOT experienced when it recently opened bids for a project providing improvements at the junction of Red Mountain, Satan Highway, and U.S. 60. The engineer's estimate for this project was \$58 million; the low bid came in at \$71 million, and the second lowest bid at \$84 million.

Highway Construction: Quarterly Update

the low bidder Kiewit Pacific for a contract amount of \$72.87 million. The second bidder on this project submitted a price of \$78.42 million, which was 2.6% over the engineer's estimate.

WSDOT's experience of a volatile bidding environment is similar to what is happening in other states (see gray box on page 43). One significant difference between Washington and other states is that WSDOT is still seeing strong competition by bidders for its projects. Other states such as Florida, California, and Arizona are reporting a decrease in the number of bidders on large projects. Some states are even experiencing an increase in the occurrence of single-bidder bid openings.

Trailing Indicators

WSDOT prepares its construction cost estimates from the information about market conditions drawn from recent bids, not from a crystal ball of future market conditions. WSDOT accumulates construction cost information into a construction cost index and compares that information against the experience of other states. WSDOT's Construction Cost Index is a composite of unit price information from low bids on seven of the most commonly used construction materials. These items reflect a composite cost for a completed item of work and include the cost of labor, equipment and materials.

The first of the graphs on page 43 shows WSDOT's experience since 1990, plotted against similar types of cost indices maintained by the Federal Highway Administration (FHWA) for the country as a whole and by the California Department of Transportation (CalTrans) for California. The second looks in greater detail at the most recent 15 quarters. FHWA has not yet released data on the two most recent quarters. WSDOT will be including Construction Cost Indices for other states in future editions.

Making information available to the public

This quarter, WSDOT began publishing its materials costs on its website. In line with the agency's "No Surprises" philosophy, details on costs trends are now available to the public with updates occurring at the end of every quarter. To view some of the most recent costs by quarter, see the graphs on page 46. These graphs, as well as costs on an annual basis from 1990 to 2004, are available at www.wsdot.wa.gov/biz/construction/constructioncosts.htm.

Fuel Cost Escalation Pilot Project

WSDOT is currently evaluating the use of an escalation clause on a pilot basis to try to buffer the impacts of fuel escalation to the contractors. This clause would shift the risk of price increases during the life of the contract from the contractor, who includes it in the bid, to the state, which would pay the increased or decreased cost of fuel during the life of the project. This clause does not eliminate the financial impact of escalation to the project, but rather shifts its risk from the contractor to the owner, to fund as it materialized throughout the project.

The Crystal Ball

In the world of markets, everyone knows by heart the disclaimer in the advertisements for mutual funds. "Past results are not a guarantee of future performance." This is precisely the case when looking ahead to national and local construction industry pricing, especially when price volatility seems inevitable from the many trends the industry now faces.

WSDOT's construction cost estimates are necessarily based completely on available trailing indicators and there is neither data nor methodology from which engineers can estimate projects based on crystal ball forecasts of changing future prices. In the Cost Estimate Validation Process (CEVP)TM, which WSDOT is applying to large projects, some account is given to baseline future inflation.

For future project costs, WSDOT applies industry standard inflation rates to base estimates in order to project year of construction costs. Recent trends indicate that tables detailing inflation rates were in need of update. The rates used on these tables were evaluated against updated industry forecasts and updated. The changes to the tables include a higher than previously forecasted inflation rate for 2004 and 2005 and an updated forecast for future years. Updating the inflation rates used to forecast future costs attempts to reflect some of the recent price trends.

Recent coverage of construction industry inflation in *The Engineering News Record*, the leading industry periodical, contained the following statements, none of which can be regarded at this time as more than the weathervanes of industry sentiment:

Highway Construction: Quarterly Update

The major uncertainty relates to the price and availability of building materials, which means in the near-term that the construction industry will continue to adjust to a higher cost structure.

A recent pre-Katrina survey of 167 public owners found that 92% of the owners experienced an average increase in their project cost of 13.2% in 2004, says John Dunkerley, chief estimator for PinnacleOne, Phoenix, which commissioned the survey. "Katrina will only aggravate those conditions," he says. "I had expected industry escalation to slip back to 5% this year. But now I'm expecting Katrina to spike it up over the next 12 to 24 months by 10 to 20% a year." (from The Engineering News Record, September 26, 2005)

What can WSDOT do?

In volatile markets, contractors must place their own contingencies against inflation into fixed price bids. If their contingencies are larger than turn out to be required, windfall profits result. The opposite is also true, and can lead contractors to significant losses on jobs. WSDOT and many other states across the country are now examining whether these risk elements can be removed from contracts in a volatile pricing environment by making bids subject to unit price adjustments from time-of-bid base bid costs. WSDOT has also worked with industry to allow contractors to expedite purchase of materials in order to be able to lock in key materials requirements for the jobs they win.

The Seven Common Construction Items That Make Up the WSDOT Construction Cost Index

The costs of these seven materials are calculated on a quarterly basis to determine WSDOT's construction cost index (CCI). Four of them are included in graphs on page 46 which show trends lines for increasing costs over the past 15 quarters.

Crushed Surfacing:

Crushed surfacing is used in construction of highways to establish a drainable base or platform underneath concrete pavement or Hot Mix Asphalt for the final roadway surface. Prices have held constant since 2004 based on the annual trendline.

Hot Mix Asphalt:

Hot Mix Asphalt is one of the common driving surfaces constructed for state roadways. Prices have increased 14.6% since the first quarter of this year based on the quarterly trendline.

Concrete Pavement:

Concrete pavement is another of the common driving surfaces constructed for state roadways. Prices have increased 13% since 2004 based on the annual trendline.

Structural Concrete:

Structural concrete is used to construct bridges and retaining walls. Prices have increased 27% since the first quarter of this year based on the quarterly trendline.

Steel Reinforcing Bar:

Steel reinforcing bars are used in bridges and retaining walls to reinforce the concrete. Prices have edged up roughly 1% since the first quarter of this year based on the quarterly trendline.

Structural Steel:

Structural steel is used to construct bridges and certain types of retaining walls. Prices have increased 9.7% since 2004 based on the annual trendline.

Roadway excavation:

Roadway excavation is the activity of moving the native material (soil) on a construction site from one area to another, or off site for disposal. Prices have increased 22% since the first quarter of this year based on the quarterly trendline.

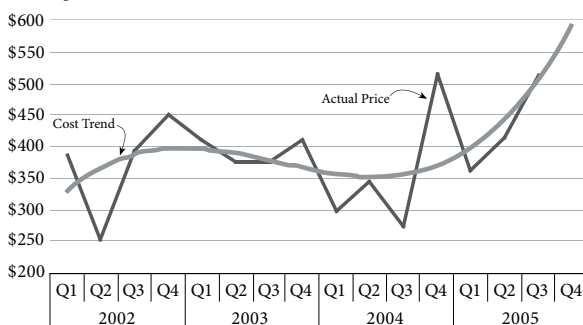
Highway Construction: Quarterly Update

Bid History Graphs

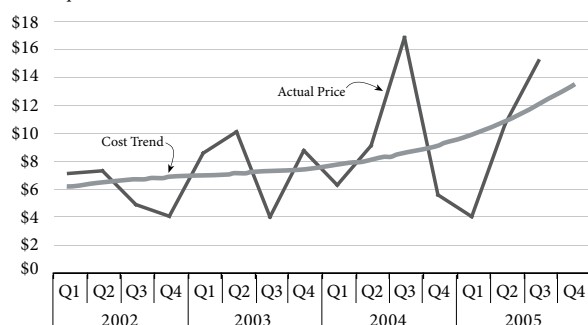
The graphs below reflect the unit bid price for four major construction materials, and exemplify the increasing cost trend. "Unit bid price" means the amount the contractor bid per unit of material (e.g., dollars per cubic yard of structural concrete). Unit bid prices include labor costs, which is standard for the highway construction industry. Exact details are difficult to derive from the graphs shown but they are very useful in describing trends. It is difficult to derive exact details

because project quantities vary substantially from project to project based on the size and geographical setting of the project. Rural projects generally tend to have unit bid prices on the lower end. Projects with larger quantities generally have lower unit prices, as the contractor is able to distribute its fixed costs over a broader base of units. With this said, the individual data points represent the trailing indicators, and the extension of the trend line is the crystal ball projection.

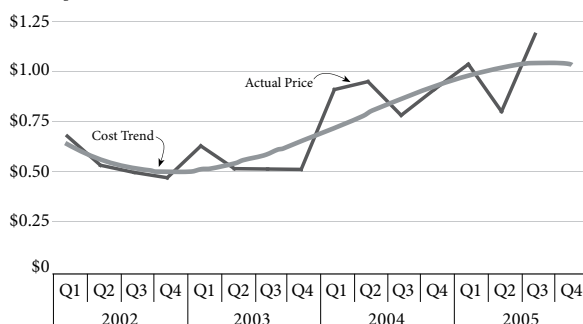
Structural Concrete
Quarterly Unit Bid Price
Dollars per Cubic Yard



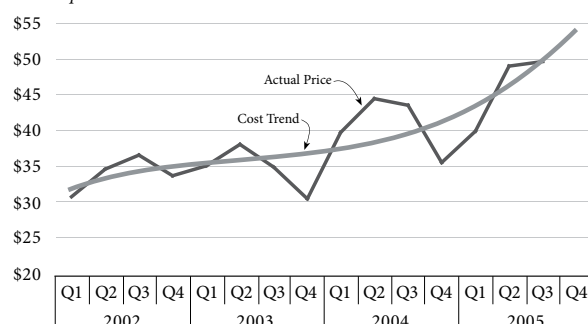
Roadway Excavation
Quarterly Unit Bid Price
Dollars per Cubic Yard



Steel Reinforcing Bar
Quarterly Unit Bid Price
Dollars per Pound



Hot Mix Asphalt
Quarterly Unit Bid Price
Dollars per Ton



Measuring Delay and Congestion: Annual Update

Construction is also scheduled to begin in Spring of 2006 for system deployment on SR 543 (truck crossing) that includes loop detectors and video surveillance. Upon completion of this project, automated wait times for both the I-5 and SR 543 crossings will be broadcast on the Variable Message Sign south of the I-5 / SR 543 interchange. Similar systems are planned for the SR 9 border crossing.

Future Plans

The next Congestion Report will contain an update on these cities with examples of congestion measurements related to construction projects, operational modifications, and other factors. For example, Spokane will be resurfacing I-90 through the downtown area during Summer of 2006. WSDOT is planning to have some excellent before and after information associated with the project.

Real-Time Data from the Performance Measurement System (PeMS) in Spokane

The Performance Measurement System (PeMS), developed at UC Berkley, was configured and installed at the Spokane Regional TMC (SRTMC) by Siemens ITS in early 2005. The SRTMC is a partnership that includes the City of Spokane, City of Spokane Valley, Spokane Valley, the Spokane Regional Transportation Council, Spokane Transit Authority and WSDOT.

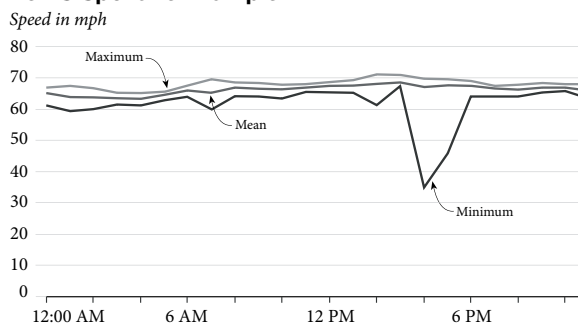
Funded by a Federal Highway demonstration project earmark, PeMS provides the region with a near real-time data warehouse, accessible to all the partnership agencies through a regional intranet connection. The regional data warehouse not only makes all data collected from the roadway systems available to all the agencies, it becomes available within minutes. The program provides a huge array of options to access, analyze, and display the data.

The figure to the right is an example of a custom display available through PeMS. The bottom line shows the impact of a traffic accident that occurred on Friday afternoon, October 28, westbound on I-90, just west of Custer Street in Spokane. The area experienced some rainfall, followed by a short period of sunlight. A four-car collision resulted in minor injuries at about 4:20 p.m. IRT and emergency personnel arrived and closed the right lane for about 30 minutes. Data collected at the time of the incident is compared to monthly mean and maximum speeds. It is easy to see the location, speed reduction and the duration of the event.

Another event occurred on eastbound I-90 between Altamont and Freya streets in Spokane at 5:33 p.m on July 5th. The scene cleared 30 minutes later. Data collected at the time of the incident is compared to normal conditions two weeks later.

PeMS also provides the ability to easily estimate the impact of a planned lane closure, allowing impacts to be minimized, or in the case of unavoidable work, communicate the level of expected delays to the public. The Eastern Region used data from this system to develop temporary lane configuration plans for a major project to resurface I-90 through downtown Spokane in the Summers of 2006 and 2007. The new system will be invaluable for effective planning as well as traffic management during construction of this high impact project.

PeMS Spokane Example



Travel Information: Quarterly Update



The 511 telephone call up system provides a variety of information affecting travel. This information includes updates on current traffic conditions, incidents, construction activities, mountain pass conditions, and weather conditions. Travelers can also obtain information about ferry, transit, airline, and railroad service. Last January, the existing 1-800-695-ROAD and 206-DOT-HIWAY numbers were directly routed to the 511 System, expediting information retrieval. This enhancement made 511 more efficient and consistent by bringing several information sources together into one system for the public's use.

Overall Trend and Total Call Volume

Calls to Travel Information begin to increase after October each year, and the monthly volume reaches its peak around December or January when mountain pass snow conditions are on travelers' minds. Prior to the winter months, the total number of calls to Travel Information is lower than in the actual winter months themselves. During the third quarter (July 1 through September 30) of 2005, there were 145,864 calls - 28.4% more than the total from the third quarter of last year. On September 11, 2005, call volumes increased 62.1% compared to September 2004. As shown in the chart at the top right, a single-day spike of 11,450 calls came in. The increase was due to calls received seeking road condition information on the day and the weekend after large rockslides at Snoqualmie Pass (see sidebar below).

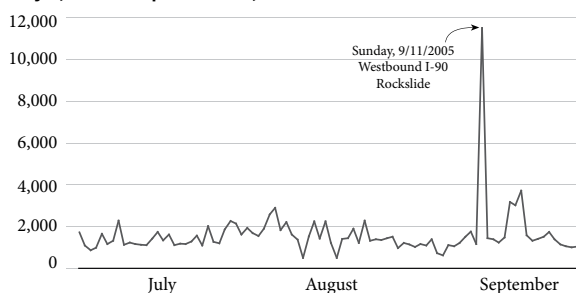
The demand for Travel Information services is also great for other "unexpected" events, such as the severe snow storm this past January 17, when 29,568 calls were received while the average daily call volume for January was 7,659.

Call Volumes Increase with I-90 Rockslide at Snoqualmie Pass

A rockslide occurred on Snoqualmie Pass in the early morning hours of September 11. The rockslide occurred on westbound I-90 at Snoqualmie Pass and claimed the lives of three individuals. The next day another large rock fell on the road; fortunately no one was injured. As a result of traffic restrictions on the pass, call volumes spiked. The average call volumes this time of year is 1,585 calls per day. On that day, the number of calls soared to 11,450 calls.

WSDOT responded to the call volumes and demands by informing the public of closures using 5-1-1 Travel Information Systems (phone), TV, radio, press releases (print), Internet, Highway Advisory Radio (HAR), and Variable Message Signs (VMS). For more information see- www.wsdot.wa.gov/Projects/I90/Rockslides/

Travel Information Service: Daily Call Volume July 1, 2005 - September 30, 2005



On the WEB

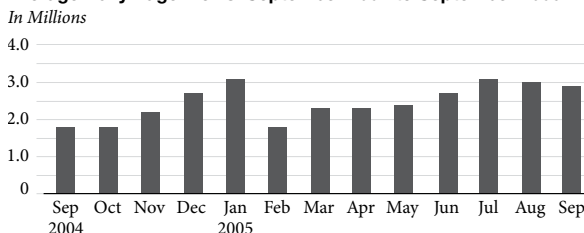
WSDOT's travel information website provides real-time road and weather information to the traveling public. On-line information that the public can access include roadway incidents, construction event updates, mountain pass information, and weather information.

Web Usage Up

Web use of travel information for September, 2005 has increased 62% since last year's total of 1.8 million page views per day. For the months of July through September, the number of page views is up an average of 46% over the same period last year. The highest month on record was January 2004 with 3.4 million page views per day. The lowest month on record was January 2003 with .6 million page views per day. The highest day during this quarter was July 1, 2005 with 5.4 million page views, as people planned their holiday weekend.

Website Usage

Average Daily Page Views: September 2004 to September 2005



Commute Options: Annual Update

2003 - 2005 CTR Performance Grant Program

Creating Cost Effective Strategies to Reduce Drive-Alone Commute Vehicle Trips

The Washington State Legislature created the Commute Trip Reduction Performance Grant Program in 2003 to encourage entrepreneurs, private companies, transit system, cities, and non-profit organizations to provide services to employees that result in fewer vehicle trips arriving at worksites. The program paid the grantees for the projected number of trips they reduced. Grant amounts between \$56 and \$460 per daily trip reduced over the course of one year were awarded. Grantees were also eligible to receive up to 50% of the award to cover start-up costs. The balance of the award was based on project performance.

The geographic distribution of projects awarded were comprised of 11 (33.3%) from the Puget Sound, 11 (33.3%) areas in Western Washington outside the Puget Sound Region, and 11 (33.3%) elsewhere in the state.

Project Awards

Thirty-three grants were awarded on a competitive basis to private employers, public agencies, nonprofit organizations, developers, and property managers. These were organizations which provided financial incentives to their own or other employees for using an alternative to drive-alone commuting, and which reduce the number of vehicle trips and miles traveled during the morning commute.

Program Successes and Areas for Improvement

One of the keys to success was offering financial incentives to employees. Twelve of the 14 grantees which exceeded their goal used financial incentives to increase participation in their project. They found that once a participant used a commute alternative, they were more inclined to continue using the alternative, even after the incentives ran out.

A review committee examined areas for improvement within the program and addressed these areas. For details on the improvement effort, and the new Trip Reduction Performance Program, please visit WSDOT's website at: www.wsdot.wa.gov/tdm/program_summaries/trpp_intro.cfm.

CTR Performance Grant Program Results

Of the 33 projects selected, 29 projects were completed:

- 14 exceeded their goal to reduce work site commute trips
- 7 made at least 50% of their goal
- 4 did not meet 50% of their goal
- 4 showed an increase in vehicle trips

The program reduced an actual total of 5,150 daily trips or an annual total of 1,287,500 vehicle trips for the year

Project Case Study

City of Redmond's Trip Reduction Incentive Project

The City of Redmond partnered with King County Metro and the Greater Redmond Transportation Management Area (TMA) to provide performance based incentives to employers for reducing the number of vehicle trips to their Redmond worksites, as well as for maintaining those trip reductions into a second year.

Project Results

- Award amount - \$123,000 (not including bonus funds)
- Projected number of daily trips reduced - 300
- Actual number of daily trips reduced - 1,032
- Actual number of annual trips reduced - 258,000
(1032 x 250 days¹ = 258,000)
- Amount per trip is \$143 calculated as follows: Award amount (\$147,600) / # of trips reduced (1,032)
- Total grant amount including bonus² - \$147,600

¹ 250 days includes Mondays and Fridays, excludes Saturdays, Sundays and Holidays

² Bonus is the amount paid (up to 120% of award amount based on the number of trips that exceeded the goal)



Marketing strategy used by the City of Redmond for the Trip Reduction Incentive Project as a part of WSDOT's CTR Performance Grant Program

calculated as (5,150 x 250 days = 1,287,500). The annualized trip cost was \$241.91. The cost of each individual trip was 97 cents per trip (obtained by calculating the annualized trip cost of \$241.91 per 250 days).

The overall program goal was exceeded by 41%. The total award amount paid was \$1,084,217.10. The total bonus amount paid was \$161,508.20

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| <ul style="list-style-type: none"> <input type="checkbox"/> Asphalt Seal Coats, WSDOT, 2003 <input type="checkbox"/> Asset Management Primer, FHWA, 1999 <input type="checkbox"/> Basic Traffic Control for Utility Operations, ATSSA, 2002 <input type="checkbox"/> Building Projects that Build Communities, WSDOT, 2003 <input type="checkbox"/> Data Integration Primer, FHWA, 2001 <input type="checkbox"/> Driving Safely While Aging Gracefully, AARP, NHTSA, 1999 <input type="checkbox"/> Dust Control on Low Volume Roads, FHWA, 2001 <input type="checkbox"/> Dust Palliative Selection and Application Guide, USDA, 1999 <input type="checkbox"/> Entering the Quiet Zone, FHWA, 2002 <input type="checkbox"/> Everyone is a Pedestrian, FHWA, 2001 <input type="checkbox"/> Family Emergency Preparedness Plan, 1999 <input type="checkbox"/> Fish Passage Through Culverts, FHWA, USDA, 1998 <input type="checkbox"/> General Field Reference Guide (Pocket Size), 2004 <input type="checkbox"/> Gravel Roads Maintenance and Design Manual, South Dakota LTAP, 2000 <input type="checkbox"/> Highway Design Handbook for Older Drivers and Pedestrians, FHWA, 2001 | <ul style="list-style-type: none"> <input type="checkbox"/> Highway Finance and Public-Private Partnerships – New Approaches to Delivering Transportation Services, FHWA, 2005 <input type="checkbox"/> HMA Pavement Smoothness, FHWA, 2002 <input type="checkbox"/> Improving Conditions for Bicycling and Walking, FHWA, 1998 <input type="checkbox"/> Improving Highway Safety at Bridges on Local Roads and Streets, FHWA, 1998 <input type="checkbox"/> Increasing Physical Activity Through Community Design, 2002 <input type="checkbox"/> Intelligent Transportation Systems in Work Zones: 3 Case Studies – Real Time Work Zone Traffic Control System; Work Zone Travel Time System; and Dynamic Lane Merge System, FHWA, October 2004 <input type="checkbox"/> Maintenance of Aggregate and Earth Roads, WST2 Center (1994 reprint) <input type="checkbox"/> Pavement Markings, FHWA, 2002 <input type="checkbox"/> Pavement Preservation Checklists, FHWA, six pocket guides: <ol style="list-style-type: none"> 1. Crack Seal Application 2. Chip Seal Application 3. Thin Hot-Mix Asphalt Overlay 4. Fog Seal Application 5. Microsurfacing Application 6. Joint Sealing Portland Cement Concrete Pavements <input type="checkbox"/> Pavement Surface Condition Field Rating Manual for Asphalt Pavement, NWPMA and WSDOT, 1999 <input type="checkbox"/> Pedestrian Safety for the Older Adult (65+), NHTSA | <ul style="list-style-type: none"> <input type="checkbox"/> Portable Changeable Message Sign Handbook (PCMS) FHWA, 2003 <input type="checkbox"/> Prefabricated Bridges 2004: Good Business-Best Practice, AASHTO TIG/FHWA <input type="checkbox"/> PCC Pavement Smoothness, FHWA, 2002 <input type="checkbox"/> Reflective Sheeting Identification Guide, FHWA, 2005 <input type="checkbox"/> Road Sign Symbols, FHWA, 2002 <input type="checkbox"/> Roadway Safety Tools for Local Agencies, NCHRP, Synthesis 321, TRB, 2003 <input type="checkbox"/> Scenic Byways Map of Washington State, 2003 <input type="checkbox"/> School Administrator's Guide to School/Walk Routes and Pedestrian Safety, WTSC, 2003 <input type="checkbox"/> The 2001 Nisqually Earthquake – Lessons Learned, WSDOT, 2001 <input type="checkbox"/> Traffic Control Handbook for Mobile Operations at Night, FHWA, 2003 <input type="checkbox"/> Trail Construction and Maintenance Notebook, USDA Forest Service, 2004 <input type="checkbox"/> A Walkable Community is More Than Just Sidewalks Brochure, FHWA, 2000 <input type="checkbox"/> Washington Bicycle Map, WSDOT, 2001 <input type="checkbox"/> Washington State Highway Map, WSDOT, 2004 <input type="checkbox"/> Wildlife Habitat Connectivity Across European Highways, FHWA, 2002 <input type="checkbox"/> Work Zone Traffic Control Guidelines, WSDOT, 2005 |
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Free Videotapes

- ☐ Danger Signs, 2004
- ☐ Driving Modern Roundabouts, City of Lacey, City of Olympia, and WSDOT, 2002
- ☐ Modern Roundabouts: Tomorrow's Solution for Today's Traffic, City of Bellingham, 2005
- ☐ Preventive Maintenance Project Selection: Right Road, Right Treatment, Right Time, FHWA, 2003
- ☐ Protecting Our Pavements: Preventive Maintenance, FHWA, 1998

Free CD ROMs

- ☐ H&LP CD Library, 7th Edition, Summer 2005 contains some of the publications listed here and many other technical documents:
 - Bicycle Safer Journey, FHWA, 2003
 - Building Projects that Build Communities, WSDOT, 2003
 - Comprehensive Intersection Resource Library
 - Driver Education Work Zone Awareness Program, ATSSA
 - Driving Modern Roundabouts, City of Lacey, City of Olympia and WSDOT, 2002
 - Emergency Relief Training for Washington State Local Agencies, WSDOT, 2004
 - Endangered Species Act – Build Smart, 2 CD set, FHWA, 2004
 - HRC-BAC: High Performance Concrete Structural Designer's Guide, 2005
 - Inspection of Ground Anchors, FHWA, 2005
 - Introduction to the Inspection of Ground Anchors and Soil Nails, FHWA, 2005

- Lightly on the Land, FHWA, 2004
- Pavement Preservation Toolbox, 2005
- Pavement Preservation 2, 2003
- School Administrator's Guide to School/Walk Routes and Student Pedestrian Safety, WTSC, 2004
- Work Zone Safety for Roadway Maintenance Operations, Interactive Training Course Advanced Technology Concepts With Rutgers University
- WSDOT Engineering Publications CD Library, March 2005

Free DVDs

- ☐ Danger Signs, 2004
- ☐ Driving Modern Roundabouts, City of Lacey, City of Olympia and WSDOT, 2002
- ☐ Pacific Northwest Transportation Technology Expo and Mousetraps
- ☐ Pedestrian Safety, City of Olympia and Washington Traffic Safety Commission, 2004
- ☐ Prefabricated Bridge Elements and Systems, AASHTO, 2005

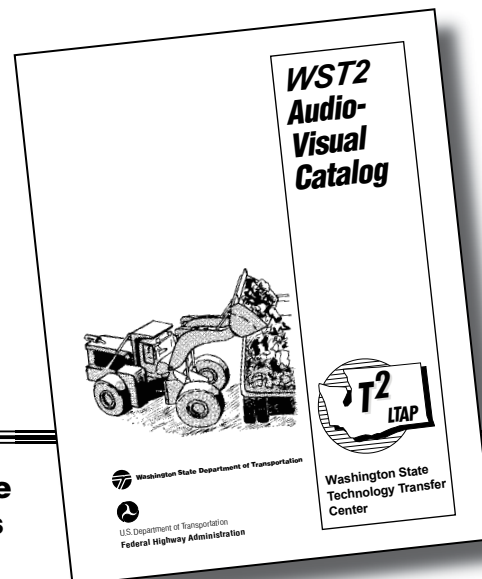
Free Workbooks and Handouts from WST2 Center Workshops

- ☐ Construction Documentation: Construction Training Manual for Local Agencies, WSDOT, 2005
- ☐ Implementing HMA (Superpave) in Local Agencies, WSDOT and FHWA, 2005
- ☐ Preparing your ECS for NEPA Approval, WSDOT H&LP, 2005

Self-Study Guides

These non-credit WSDOT self-study guides may be obtained from the WST2 Center. An invoice will be sent with the books.

- Basic Surveying, \$20
- Advanced Surveying (metric), \$20
- Contract Plans Reading, \$25
- Technical Mathematics I, \$20
- Technical Mathematics II, \$20
- Basic Metric System, \$20



**View the entire
WST2 Center's
Video Lending
Library online!**

<http://www.wsdot.wa.gov/TA/T2Center/AVC.pdf>

New Videos in Video Lending Library!

The WST2 Center has added new videos, CDs, and DVDs to our Video Lending Library. Here are some of the new additions. Agencies and consultants inside Washington State may borrow up to five at a time for three weeks. Call (360) 705-7386 to order, or e-mail WST2Center@wsdot.wa.gov

System Requirements for the following CD items: 486/100 MHz (minimum), CD-ROM, 8 MB RAM, Sound Card. Available Hard Disk Space 3 MB. Windows 95, 98, NT 4.0, 2000, or Windows XP.

Learn valuable word processing skills in Microsoft Word with these step-by-step tutorials on CD ROM, Microsoft Office 2003 (Desktop Series).

- ☐ 516 Word Level 1
- ☐ 517 Word Level 2
- ☐ 518 Word Level 3
- ☐ 519 Word Level 4
- ☐ 520 Word Level 5

Learn valuable spreadsheet processing skills in Microsoft Excel with these step-by-step tutorials on CD ROM, Microsoft Office 2003 (Desktop Series).

- ☐ 521 Excel Level 1, Beginning
- ☐ 522 Excel Level 2, Intermediate
- ☐ 523 Excel Level 3, Advanced
- ☐ 524 Excel Level 6
- ☐ 525 Excel Level 7

Learn valuable database skills in Microsoft Access with these step-by-step tutorials on CD ROM, Microsoft Office 2003 (Desktop Series).

- ☐ 526 Access Level 1
- ☐ 527 Access Level 2
- ☐ 528 Access Level 3

Learn valuable presentation skills in Microsoft PowerPoint with these step-by-step tutorials on CD ROM, Microsoft Office 2003 (Desktop Series).

- ☐ 529 PowerPoint 2003 Level 1
- ☐ 530 PowerPoint 2003 Level 2
- ☐ 531 PowerPoint 2003 Level 3
- ☐ 532 PowerPoint 2003 Level 4

Learn valuable communication skills in Microsoft Excel with these step-by-step tutorials on CD ROM, Microsoft Office 2003 (Desktop Series).

- ☐ 533 Outlook 2003 Level 1
- ☐ 534 Outlook 2003 Level 2
- ☐ 535 Outlook 2003 Level 3

Here are some other new videos, CDs, and DVDs:

- ☐ 536 **Commercial Driver's License Course.** Complete CDL Training Course on one CD ROM and two guides: General Knowledge and Skills, and Endorsements-Air Brakes, Passenger, Hazardous Materials, Combination Vehicle, Doubles and Triples, and Tank Endorsement.
- ☐ 537 **Asbestos in Construction.** 15 min. This program will help those who come into contact with building materials comply with OSHA 1926.1101 and understand that asbestos must be handled with care in order to maintain a safe work environment. Work activities regulated by the standard, respiratory protection, exposure assessment.
- ☐ 538 **Pro-Active Safety Attitudes: Looking Out for Number One** (Handbooks) (Large Case). 19 min. This Trainer's Toolkit underscores the importance of safety equipment and safety habits, and demands that all employees take responsibility for safety. Includes video, handbooks, and leader's guide with customizable PowerPoint presentation.
- ☐ 539 **Manbaskets in Construction.** 10 min. This video is designed to teach workers the proper procedures for hoisting and using a crane or derrick. Covers pre-lift meeting, inspection and testing, personnel platforms, loading, and crane operations.
- ☐ 540 **Scissor Lifts in Construction, Hard Hat Safety Series.** 9 min. Scissor lifts can provide a safe walking and working surface on construction sites; however, proper training is essential. This program teaches workers what they need to know: lifting principles, pre-work walk-around inspections, controls, training, safe operation, electricity.
- ☐ 541 **Boom Lifts in Construction, Hard Hat Safety Series.** 11 min. Boom lifts are the most widely used type of equipment on a construction site. This video provides workers with

the training necessary to keep them safe: lifting principles, walk-around inspections, controls, electricity, and operation.

- ☐ 542 **Contractor Safety: It's Everybody's Business.** 17 min. This video shows how to protect yourself and co-workers from injury when working in multi-employer sites. General requirements, fire safety, personal protective equipment, permit-required confined spaces, trenching and shoring, lockout/tag out, hot work, chemical safety.
- ☐ 543 **Task Exposure Analysis: Beginning the Pro-Active Safety Process.** 19 min. This video helps supervisors and employees predict where an incident could become a hazard and develop into an accident. How Task Exposure Analysis works, preparing for TEA, the four-step plan.
- ☐ 544 **Working Around Cranes.** 19 min. This video teaches how to identify and prevent the hazards of working around cranes. It shows proper PPE to wear around cranes, proper crane assembly, and dis-cusses the "sweep area," wire rope for lifting, slings, taglines, working around power lines, and standardized signaling.
- ☐ 545 **Avoiding Litigation Landmines: A Survival Guide for Managers.** 30 min. Supervisors learn the importance of employee performance documentation, equal treatment of all employees, training scheduling and follow-up, the public nature of e-mail, and other "landmines." Utilize your agency's human resource department for assistance early to avoid problems or litigation.
- ☐ 546 **PPE: Don't Start Work Without It (Safety 101 Series).** 13 min. Different parts of your body and different hazards require different forms of personal protective equipment. Learn to use the right protective equipment for each job correctly: eyes and face, hand and foot, ears/hearing, head protection, basic PPE rules.
- ☐ 547 **Dealing With Stress: Stress Management in the Workplace.** 18 min. Learn that stress is tension caused by your reaction to external stimuli. Learn what happens to your body when stressed, how to handle stressful situations, the body's cycle, how your diet, smoking, drugs, alcohol, and caffeine affect your ability to control stress, the importance of exercise and water.

- ❑ **548 Rigging Equipment Basics.** 20 min. Basic terminology for the rigging used in lifting loads with cranes. Breaking strength, Working Load Limit (WLL), Safe Working Limit (SWL), slings and hitches, the importance of a written pre-lift plan, using the correct gear, types of wire ropes, synthetic web slings, end fittings, and types of clips.
- ❑ **549 DOT Drug and Alcohol Testing: Your Rights and Responsibilities.** 20 min. The U.S. Department of Transportation's Alcohol and Testing Rule says employers must train drivers on the dangers of alcohol and controlled substances, and the potential consequences of their misuse. Shows effects of substance abuse on job performance, conditions for testing, and the collection procedure.
- ❑ **550 Safer Journey CD ROM: Interactive Pedestrian Safety Awareness.** Collisions between pedestrians and motor vehicles are a serious problem. Annually, pedestrians account for almost 14 percent of all motor vehicle deaths nationwide. This CD was developed to improve the level of pedestrian knowledge for all road users and safety practitioners.
- ❑ **551 Moving Safely Across America CD ROM.** The Interactive Highway Safety Experience was developed to improve the level of highway safety knowledge for the average driver in the effort to improve safety on our highways. Driver error is associated with many highway crashes.
- ❑ **552 Endangered Species Act Build Smart CD ROM.** This two CD set provides an interactive explanation of key elements of the ESA related to highway construction. Disk 1: Introduction to and compliance with ESA, a review of duties an agency has under ESA. Disk 2: Constructing to requirements of ESA, two case histories and additional resources.
- ❑ **553 Common Sense Solutions to Intersection Safety Problems CD ROM.** This CD contains workshop materials for the use of local transportation managers who want to educate citizens, officials, law enforcement, etc. about basic intersection safety issues and concerns. Covers crash statistics, proper sign placement, traffic signals, red light running, pedestrians and more.

- ❑ **554 Winter Maintenance Training Materials Volume 2 CD ROM.** This CD ROM reviews preparations for snow removal operations, actual plowing and spreading operations using a variety of equipment, materials, and techniques. Emphasizes sensible salting, deicing, prewetting, anti-icing, pick-up and disposal, special areas, record-keeping, and the environment.
- ❑ **555 Interactive Highway Safety Design Model CD ROM.** IHSDM is a suite of software analysis tools for explicit, quantitative evaluation of safety and operational effects of geometric design on two-lane rural highways. IHSDM results support decision-making throughout the highway design process.
- ❑ **556 Excavation Safety.** 23 min. Learn how to understand and recognize excavation hazards and how to deal with excavation emergencies. A Safety and Health Excavation Plan involves: (1) Analysis of the Work, (2) Site Preparation, (3) The Operation, and (4) Identify Which Protective Systems to Utilize.
- ❑ **557 Managing Power Line Hazards.** 9 min. Identify and eliminate the risks of power lines in and near your worksite. Make a project specific site plan showing the location of all overhead and buried power lines. What equipment will be on the jobsite-what can it hit? Request lines be de-energized, shield the line. Train for emergencies.
- ❑ **558 Power Line Hazard Awareness.** 19 min. Introduction by Cliff Meidl, U.S. Olympic Kayak Team, who was injured when the jackhammer he was operating hit a buried power line. Power lines are not insulated, only coated for weather protection. Know where wires are located, stay away, use warning lines, observer, and protective devices.
- ❑ **559 Safety: It's Up to Me.** 10 min. Presented in live performance at the 14th Annual Construction Safety Conference, Leading the Way. An oversight in safe work practice, innocently committed, has a deadly outcome, with devastating effects on the victim's family, co-workers, and supervisors.

On-line Resources

Bridge

- WSDOT Highways and Local Programs
<http://www.wsdot.wa.gov/TA/Operations/BRIDGE/BRIDGEHP.HTM>

Environmental

- *Environmental Procedures Manual* (M31-11)
<http://www.wsdot.wa.gov/fasc/EngineeringPublications/Manuals/EPM/EPM.htm>
- Regional Road Maintenance Endangered Species Act Program Guidelines
<http://www.metrokc.gov/roadcon/bmp/pdfguide.htm>
- National Marine Fisheries Service Species Listings and Info
<http://www.nwr.noaa.gov/>
- U.S. Fish and Wildlife Service Species Listings and Info
<http://endangered.fws.gov/>
- Washington State DNR's Natural Heritage Program Home Page
<http://www.wa.gov/dnr/htdocs/fr/nhp/refdesk/fsrefix.htm>
- FHWA's Environmental Home Page
<http://www.fhwa.dot.gov/environment/index.htm>

Highways and Local Programs List Servs

For the following list servs:

- WST2 Newsletter
- WST2 Training
- Traffic Technology and Safety

Use the following address to sign up:

<http://www.wsdot.wa.gov/TA/T2Center/T2hp.htm>

WSDOT Materials Lab

- <http://www.wsdot.wa.gov/biz/mats>

Infrastructure Management and GIS/GPS

The site below has been established to promote interagency data exchange and resources sharing between local governmental agencies.

<http://www.wsdot.wa.gov/TA/T2Center/Mgt.Systems/InfrastructureTechnology/InfThp.html>

Legal Search

- Search RCWs and WACs
<http://search.leg.wa.gov/pub/textsearch/default.asp>

Local Agency Guidelines (LAG) Manual

- <http://www.wsdot.wa.gov/TA/Operations/LAG/LAGHP.htm>

Pavement Management

- Pavement Publications and NWPMA Links
<http://www.wsdot.wa.gov/TA/T2Center/Mgt.Systems/PavementTechnology>
- NWPMA – North West Pavement Management Association
<http://www.wsdot.wa.gov/TA/T2Center/Mgt.Systems/PavementTechnology/nwpma.html>
- Asphalt Institute
<http://www.asphaltinstitute.org/>
- National Asphalt Pavement Association
<http://www.hotmix.org/>
- Pavement (A Website for Managing Pavements)
<http://www.mincad.com.au/pavenet>
- SuperPave Information
<http://www.utexas.edu/research/superpave>

Project Development

- Federal Aid Progress Billing Form
<http://www.wsdot.wa.gov/TA/ProgMgt/Projectinfo/BILLFORM.XLS>
- State Funded Progress Billing Form
<http://www.wsdot.wa.gov/TA/ProgMgt/Projectinfo/BILLFORM.STATE.xls>
- STIP (State Transportation Improvement Program)
<http://www.wsdot.wa.gov/TA/ProgMgt/STIP/STIPHP.htm>

- TIP (Local Agency 6-Year Transportation Improvement Program)
<http://www.wsdot.wa.gov/TA/ProgMgt/STIP/TIP.html>

Research

- WSDOT Research Office
<http://www.wsdot.wa.gov/research>
- Looking for a Transportation Research Publication?
<http://gulliver.trb.org>
- Municipal Research and Services Center of Washington
<http://www.mrsc.org>

Traffic and Safety

- Safety Management Publications and Information
<http://www.wsdot.wa.gov/TA/T2Center/Mgt.Systems/SafetyTechnology/>
- WSDOT Traffic Data Office
<http://www.wsdot.wa.gov/mapsdata/tdo/>
- Washington State Patrol
<http://www.wsp.wa.gov>
- Washington Traffic Safety Commission
<http://www.wtsc.wa.gov>
- National Highway Traffic Safety Administration
<http://www.nhtsa.dot.gov>
- American Traffic Safety Services Association
<http://www.atssa.com>
- Municipal Research and Services Center of Washington
<http://www.mrsc.org>
- Transportation Research Board
<http://gulliver.trb.org>

Training

- WST2 Classes
<http://www.wsdot.wa.gov/TA/T2Center/Training/>
- WST2 Class Registration
http://fmapps.wsdot.wa.gov/tbase_registration/
- County Road Administration Board
<http://www.crab.wa.gov/>
- American Public Works Association
<http://www.apwa.net/education>
- Transportation Partnership in Engineering Education Development (TRANSPEED)
<http://www.engr.washington.edu/epp>

WSDOT Local Programs Engineers

- Eastern Region (Spokane)
Keith Martin, (509) 324-6080,
martink@wsdot.wa.gov
- Northwest Region (Seattle)
Ed Conyers, (206) 440-4734,
conyere@wsdot.wa.gov
- Olympic Region (Olympia)
Neal Campbell, (360) 357-2666,
campben@wsdot.wa.gov
- North Central Region (Wenatchee)
Paul Mahre, (509) 667-3090 or 667-2900,
mahrep@wsdot.wa.gov
- South Central Region (Yakima)
Roger Arms, (509) 577-1780,
armsr@wsdot.wa.gov
- Southwest Region (Vancouver)
Bill Pierce, (360) 905-2215,
pierceb@wsdot.wa.gov

Other On-line Resources

- Bicycle maps and other information
<http://www.wsdot.wa.gov/bike/>
- Pedestrian information
<http://www.wsdot.wa.gov/walk/>
- Rural Partnerships and scenic byways information
<http://www.wsdot.wa.gov/TA/programt/byways/>
- Better Mousetraps
<http://www.wsdot.wa.gov/TA/T2Center/Mousetraps/>
- Retired Professional Program
<http://www.wsdot.wa.gov/TA/T2Center/Retired.htm>
- LTAP (Local Technical Assistance Program) Clearing House
<http://www.ltapt2.org>
- Institute of Transportation Engineers
<http://www.ite.org>
- Washington State Counties
<http://mrsc.org/byndmrsc/counties.aspx>
- Washington State Cities and Towns
<http://mrsc.org/byndmrsc/cities.aspx>
- Governor's Office of Indian Affairs
<http://www.goia.wa.gov>
- Southwest Interagency Coop-Grounds Equipment Maintenance (GEM)
<http://www.gematwork.org>

Washington State T2 Center

Contact: Laurel Gray (360) 705-7355
Wendy Schmidt (360) 705-7386
<http://www.wsdot.wa.gov/TA/T2Center/Training>

To register for a class in this section, use the contacts listed above.

The class fees shown apply to both public and private sector students. The most up-to-date information on these courses, and a link to the on-line registration form, can be found on the website listed above.

The following 2006 classes are now available for on-line registration:

AGI32 Intermediate/Advanced Roadway Lighting

February 14-16, Tumwater. **\$1,075.** This course is geared toward AGI32 (Advanced Graphical Interface 32 bit – Illumination Design Software) users who are well versed in the AGI32 basic concepts and have a good understanding of lighting fundamentals. Training is application oriented, encompassing the best practices to create and analyze diverse roadway lighting solutions. Covered applications include multideck roadway design incorporating high mast lighting, underdeck lighting, and object creation; tunnel lighting creation with electric lighting, and daylighting considerations. Luminaire photometry and calculation restrictions will be briefly reviewed as well.

Basics of a Good Gravel Road

May 2, Kennewick. **\$45.** This is a basic road maintenance class. All major problems of unpaved gravel roads will be addressed including washboarding (corrugation), traffic patterns, rutting, surface drainage, dust control, surface material, and roadside obstruction. The techniques that Mr. Heiden teaches can help to reduce unpaved road maintenance expenditures by up to 40 percent of current expenditures in three to five years.

Bridge Condition Inspection Update (BCIU)

February 1-2, Moses Lake; February 15-16, Lacey. **Free.** Instructor: Grant Griffin, WSDOT Bridge Engineer. This course will provide information on the latest inspection manual, Laptop98 bridge inspection software, bridge file records, and other important bridge inspection issues. Sufficiency ratings and proper coding of bridge elements will also be discussed.

Bridge Condition Inspection Fundamentals (BCIF)

February 7-9, Lacey. **Free to Washington State local agencies and consultants. All others \$150.** Instructor: Grant Griffin, WSDOT Bridge Engineer. This course is designed to provide basic knowledge of bridge condition inspection, construction materials, material properties, bridge components and nomenclatures, loadings, stresses and strains, and deterioration of bridge materials and members. This course is preparatory for Bridge Condition Inspection Training. Graduate engineers or engineering technicians with bridge experience need not attend.

Bridge Condition Inspection Training (BCIT)

March 13-17, and March 20-24, Lacey. This course is two full week; attendance both weeks is required. **Free to Washington State local agencies and consultants. All others \$700.** Instruction by WSDOT Bridge, Highways and Local Programs, Hydraulics Section, and FHWA. This course is based on the FHWA "Bridge Inspector's Reference Manual" and will provide extensive training on the condition inspection of in-service bridges. Two comprehensive examinations will be administered: a field exam covering inspection and inventory coding, and a multiple choice classroom exam. Satisfactory completion of this course will fulfill the training requirements of the National Bridge Inspection Standards (NBIS) for a "comprehensive training course" based on the reference manual. This training is for new bridge inspectors or those who desire a refresher. Non-engineers and people with little or no bridge condition inspection experience are strongly advised to attend the Bridge Condition Inspection Fundamentals (BCIF) class prior to BCIT. There will be several days in the field.

Construction Documentation

February 1, Tumwater; February 14, Wenatchee; February 16, Kennewick; March 14, Burlington; March 15, Bellevue. **Free.** Instructor: Ken Hash, WSDOT Southwest Region Engineer. Regional Local Program Engineers will be in attendance at each class to answer questions. This course covers three project phases: pre-contract, contract, and post-contract documentation of public works projects with FHWA funding. Local agency and contractor's documentation is discussed, with a strong emphasis on the documentation requirements of the field inspector. On completion of this course, participants will have a working knowledge of: (1) required documentation that will be submitted by the contractor, (2) required documentation for acceptance of contract materials, (3) daily inspector's documentation of the contract work, and (4) source documentation for the monthly progress payment to the contractor.

Context Sensitive Solutions

March 7-8, Shoreline; March 15-16, Lacey; April 4-5, Spokane. **Free.** Instructors: John Heinley and Robert Kutrich, WSDOT. This course will provide the knowledge and skills to collaboratively develop transportation projects addressing the needs of a broad range of users and interested parties. Participants will learn to identify critical issues, involve stakeholders, evaluate alternatives and minimize tort liability when developing solutions to transportation issues that are specific to individual sites.

Contract Specification Writing

May 23, Vancouver; September 13, Seattle; October 19, Tumwater; November 7, Bellingham. **\$75.** Instructor: Steve Boesel. This class will provide guidance and methods for writing consistently clear, concise, complete and well formatted contract special provisions. It will provide a thought process that can be used when writing or reviewing contract specifications to ensure the greatest possibility for a successful bid and a successful construction project.

Cultural Resources Training

Sessions are scheduled for May and October every year. The Dalles, Oregon. **\$350.** Three and a half days of training. This training will introduce participants to the value and significance of Washington's irreplaceable cultural resources. The class provides an exceptional opportunity for local agencies to work with the northwest's most qualified instructors, visiting some of the area's finest examples of cultural resources and attending the only statewide training session of this caliber. For any individual who wants to become knowledgeable about cultural resources and possess the necessary skills to address basic resource management problems associated with cultural resources. Call the T2 office to have your name placed on a wait list for the next class; this course is not available for on-line registration.

Modern Chip Seal Techniques

April 11, Spokane; April 13, Yakima; April 18, Arlington; April 19, Tukwila; April 20, Tumwater. **\$50.** Instructor: Phil Barto, P.E., retired Spokane County Operations Engineer. This course will cover: asphalt chemistry, the purpose of chip sealing, asphalt and aggregates for chip sealing, design, supervising the chip seal crews, equipment preparation, calibration and maintenance, constructing a chip seal, weather conditions, and cost management.

Pavement Condition Rating

May 9-10, Ellensburg; May 23-24, Tacoma; September 12-13, Tacoma. **Free.** Instructor: Bob Brooks, WST2 Pavement Engineer. Participants will learn to rate any of the pavements commonly found in Washington. The rating values obtained using the definitions and methods learned in this course should compare favorably with those obtained and used in the Washington State Pavement Management System. Upon completion each participant should be able to perform a pavement condition survey with reasonable objectivity.

Roadway Drainage

May 4, Moses Lake; May 9, Mount Vernon; May 11, Lacey. **\$45.** This workshop will discuss appropriate methods to use in determining proper size of ditches and pipes as well as the proper method of constructing and maintaining each.

- Basic Road Design Characteristics
- Basic Soil Characteristics
- Basic Hydrology
 - Drainage Areas
 - Runoff Factors
 - Rainfall Intensity
- Hydraulics
 - Culvert Materials
 - Sizing Culvert
 - Sizing Ditches
- Placement of Culverts
- Culvert End Treatments
- Culvert and Ditch Maintenance

WSDOT Construction and Design Courses

WSDOT courses are available for local agency attendance in the Design and Construction fields. Attendance is limited to cities, counties, ports, tribes, transit agencies, and consultants acting as official city engineer. **Classes are free.** Classes are available in Seattle, Olympia, Vancouver, Yakima, Wenatchee, and Spokane. Each course generally offers six to eight class sessions per year with 20 percent of the seats in each class being reserved for local agencies, the rest are for WSDOT employees. All classes are posted on the WST2 training website and registrations are accepted online. You will find more information on our website along with descriptions for these courses.

Design training season is September through March.

- Roadside Safety (B74)
- Project Management Process (formerly titled Managing Project Delivery) (B71)
- WSDOT Interchange Design (CFU)
- Intersection and Pedestrian Design (CBD)
- Roadway Geometric Design (BWE)

Construction training season is January through May.

- Excavation and Embankments Inspection (AC3)
- Nuclear Gauge Safety and Operation (ALG)
- Nuclear Gauge, Embankment/Surfacing/Pavement Applications (ANQ)
- Electrical-Illumination and Signals (API)
- Drainage Inspection (ACF)
- Hot Mix Asphalt Placement (ACB)
- Bridge and Structures Inspection 201 (CQ9)
- Bituminous Surface Treatment Inspection (ACC)

GPS Training

The following Basic, Intermediate and Advanced GPS training courses are available by special request to be held either in WSDOT's Tumwater computer lab or your agency. Four to six students per session. The courses are taught by WSDOT's Trimble-certified instructor. Expenses of the instructor are in lieu of the cost of the course if you choose to have the training in your agency. Call the WST2 Office for information or to schedule training.

- **Basic Mapping and GPS Certified Training** – A one-day course. **\$100 per person.** This course teaches the basics of GPS and how to collect data using Trimble Mapping and GIS GPS equipment. Course topics are: GPS fundamentals, configuring the GPS equipment, field data collection techniques, and a field data collection session including downloading collected data to an office workstation. The training will include both a classroom session and a field exercise.

- **Intermediate Mapping and GPS Certified Training** – A two-day course. **\$200 per person.** This course includes all topics covered in the one-day training course, plus the following topics: mission planning, data dictionary creation, advanced data collection techniques, differential correction using GPS Pathfinder Office, exporting data to your GIS and two field sessions utilizing advanced data collection techniques. The training will include classroom sessions and two field exercises.

- **Advanced GPS Mapping Grade Equipment Training** – A two-day course. **\$200 per person.** This course is designed to provide advanced knowledge and skills in GPS mapping grade equipment, mission planning, data collection, data processing, and field techniques. The training will enable personnel who collect data to improve skills and techniques in collecting and processing data. The course can be tailored to specific mission or projects or scheduled as a follow up to the Basic or Intermediate course. The training will include classroom sessions and field exercises.

What We're Working On

- Superpave Academy: May 15-18, Wenatchee; June 12-15, Vancouver
- Designing Accessible Pedestrian Facilities
- Troubleshooting Roundabout Design
- Pedestrian Facility Design Training Conference: May 12, 2006, Burien
- Purchasing, Bidding, and Contract Management

TRANSPEED

University of Washington

Contact: Julie Smith
(206) 543-5539, toll free 1-866-791-1275
fax (206) 543-2352
jsmith@engr.washington.edu
<http://www.engr.washington.edu/epp>

To register for a class in this section, use the contact listed above.

Endangered Species Act 4(d) Training Program

The Regional Road Maintenance ESA Training Program courses offered by the University of Washington include the following courses. Check their website for descriptions of courses, and dates and locations of class sessions.

Track 2: Introduction, Design and BMPs, Monitoring, and Environmental Roles for Engineering, Technical and Scientific Staff

Track 3: Classroom Introduction to ESA and Outcome-based Road Maintenance for Field Crews

Track 3B: Field BMP Training for Bridges Consistent with NPDES

Track 3F: Road Maintenance Crew Training in the Field Environment: Applying Maintenance BMPs

Track 3W: Road Maintenance Crew Training in the Field Environment: Applying BMPs in Water Work (course currently under development)

TRANSPEED

University of Washington

Contact: Christy Pack or Heather Davis
(206) 543-5539, toll free 1-866-791-1275
fax (206) 543-2352
<http://www.engr.washington.edu/epp>

To register for a class in this section, use the contact listed above.

The prices in this section are for local agency / non-local agency.

Stormwater Engineering for Transportation Professionals

February 14-16, Seattle. \$320/\$470

Traffic Engineering Operations

March 14-16, Lacey. \$355/\$500

Administering Consultant Contracts

March 21, Seattle. \$220/\$420

Retaining Walls Type Selection and Layout

March 28, Seattle. \$175/\$300

Urban Street Design

April 11-13, Seattle. \$385/\$550

Pavement Rehabilitation

April 18-20, Vancouver. \$485/\$600

Legal Liability for Transportation Professionals

April 25-26, Spokane. \$305/\$450

Work Zone Traffic Control Plan (TCP) Design

May 2-4, Spokane. \$390/\$590

Manual on Uniform Traffic Control Devices

May 9-11, Seattle. \$370/\$570

Roundabout Applications

May 17-18, Seattle. \$370/\$570

Hydrology and Basic Hydraulics

May 24-25, Lacey. \$270/\$450

Construction Inspection of Public Works Projects

June 5-6, Seattle. \$370/\$570

Public Works Construction Project Management

June 7-8, Seattle. \$270/\$470

Roadway Geometric Design 1: Basic Concepts and Principles

June 28-29, Seattle. \$300/\$500

Associated General Contractors Education Foundation

Contact Beth Sachse
(206) 284-4500, fax (206) 284-4595
bsachse@agcwa.com
<http://www.constructionfoundation.org>

To register for a class in this section, use the contact listed above.

Construction Site Erosion and Sediment Control Certification

These WSDOT approved classes are presented by the AGC Education Foundation and available on the following dates:

2006 Dates: February 24, Seattle; March 24, Everett; April 21, Tacoma; May 19, Seattle; June 23, Tacoma; July 21, Seattle.

Certification and recertification training on the same day.
\$225/\$250.

Other Training Opportunities

Engineering Professional Programs (EPP)

University of Washington
(206) 543-5539
Engineering Refresher Courses
<http://www.engr.washington.edu/epp>

Professional Engineering Practice Liaison (PEPL)

University of Washington
(206) 543-5539
<http://www.engr.washington.edu/epp>

Washington Environmental Training Center

Green River Community College, Auburn
1-800-562-0858
<http://www.greenriver.edu/wetrc>

Click, Listen and Learn

American Public Works Association
(816) 472-6100
<http://www.apwa.net/education/cll/>

Washington State Emergency Management Division

(253) 512-7048 or (253) 512-7000
<http://emd.wa.gov/>

Washington State Department of Personnel (DOP)

Human Resource Development Services
(360) 664-1921
<http://hr.dop.wa.gov/training>

Evergreen Safety Council

(206) 382-4090 or 1-800-521-0778
<http://www.esc.org>

Conferences

2006 Concrete Pavement Seminar

February 14-16, 2006, Skamania Lodge, Stevenson.
Sponsored by American Concrete Pavement Association,
NW Chapter. Topics: Tire/Pavement Noise, pavement
Design, Pavement Rehabilitation, Pervious Pavement,
Engineered Soils. For more information, call (360) 956-7080
or e-mail Lynn Ledgerwood.

Road Builders' Clinic

February 28-March 2, 2006, Coeur D'Alene Hotel, Coeur
D'Alene, Idaho. Contact Washington State University for
more information (509) 335-3530.

APWA Fall Conferences

Spring 2006: March 28-31, 2006, Vancouver Convention
Center. Joint Oregon/Washington. Contact Katherine
Claeys at (360) 676-6961.

Fall 2006: October 16-20, 2006, Wenatchee
Convention Center. Contact Ruta Jones at
(509) 664-3364 or Dick McKinley at (360) 676-6961
for information about either of these conferences
or <http://www.apwa-wa.org/>

Livable Communities Fair

April 8, 2006, Puyallup Fair Grounds, Puyallup.
9:00-4:00. For more information, contact Paula Reeves
at (360) 705-7258 or reevesp@wsdot.wa.gov

Northwest Pavement Management Association (NWPMA)

Spring Conference, April 19-20, 2006, Kennewick.
For more information, contact Bob Brooks at
(369) 705-7352 or brookbo@wsdot.wa.gov

Pacific Northwest Transportation Technology Expo

September 2006, Chehalis. View on-line clips of past
Expos at <http://www.wsdot.wa.gov/ta/t2center/technoexpo/>

AASHTO Roadside Design Guide, Web-based Training

NHI Course Number: 380032C

This web-based course is approximately 14 hours long and is available anytime — 24 hours, 365 days a year via the Internet. The cost for non-FHWA employees is \$230 per participant and includes a copy of the 2002 AASHTO "Roadside Design Guide." This course provides an overview of the 2002 AASHTO "Roadside Design Guide." Emphasis is on current highway agency policies and practices. Participants must register on-line at <http://www.nhi.fhwa.dot.gov/registerdl.asp>

Computer Requirements: You will need a fairly recent version of a browser (such as Internet Explorer 4 or 5 or Netscape 4 with JavaScript enabled), the latest version of Macromedia Shockwave and Flash (which you can download from the Internet), and a connection to the Internet (at least 56K modem). An older computer such as a Pentium 100 would work, but it would be slower than a Pentium III. For more information, visit <http://www.nhi.fhwa.dot.gov>



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WSDOT – H&LP Division

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